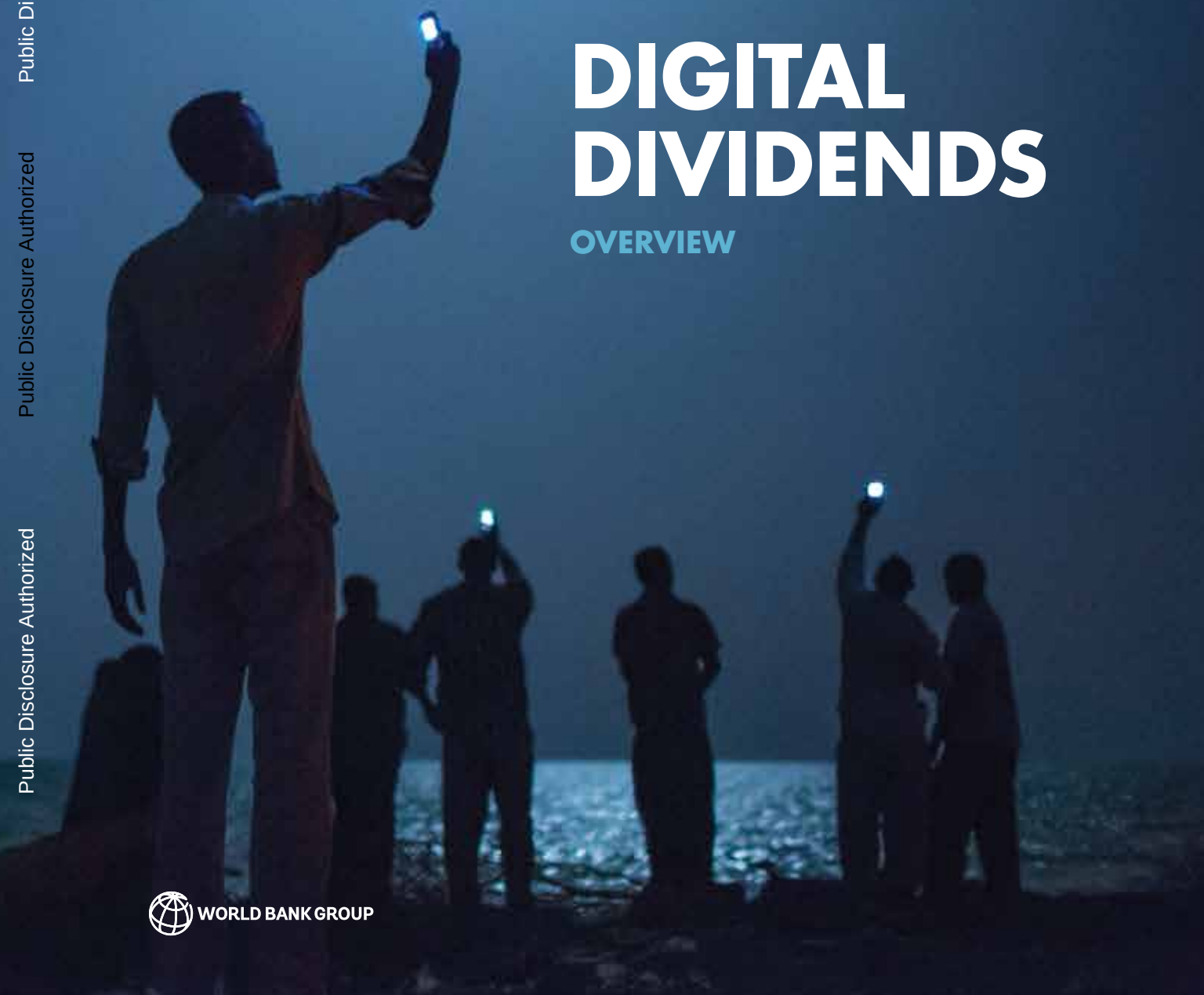
A World Bank Group Flagship Report

world development report 2016

DIGITAL DIVIDENDS

OVERVIEW



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This booklet contains the overview, as well as a list of contents, from the *World Development Report 2016: Digital Dividends*, doi: 10.1596/978-1-4648-0671-1. A PDF of the final, full-length book, once published, will be available at https://openknowledge.worldbank.org/, and print copies can be ordered at http://Amazon.com. Please use the final version of the book for citation, reproduction, and adaptation purposes.

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Cover photo: This 2013 World Press Photo of the Year shows migrants crowding the night shore of Djibouti City in an attempt to capture inexpensive cellphone signals from neighboring Somalia. © John Stanmeyer/National Geographic Creative. Used with the permission of John Stanmeyer/National Geographic Creative. Further permission required for reuse.

Contents

Foreword

We find ourselves in the midst of the greatest information and communications revolution in human history. More than 40 percent of the world's population has access to the internet, with new users coming online every day. Among the poorest 20 percent of households, nearly 7 out of 10 have a mobile phone. The poorest households are more likely to have access to mobile phones than to toilets or clean water.

We must take advantage of this rapid technological change to make the world more prosperous and inclusive. This Report finds that traditional development challenges are preventing the digital revolution from fulfilling its transformative potential.

For many people, today's increase in access to digital technologies brings more choice and greater convenience. Through inclusion, efficiency, and innovation, access provides opportunities that were previously out of reach to the poor and disadvantaged.

In Kenya, for example, the cost of sending remittances dropped by up to 90 percent after the introduction of M-Pesa, a digital payment system. New technologies allow women to participate more easily in the labor market—as e-commerce entrepreneurs, in online work, or in business-process outsourcing. The world's 1 billion persons with disabilities—80 percent of whom live in developing countries—can lead more productive lives with the help of text, voice, and video communication. And digital ID systems can provide better access to public and private services for the 2.4 billion people who lack formal identification records, such as a birth certificate.

While this is great progress, many are still left out because they do not have access to digital technologies. Those in extreme poverty have the most to gain from better communication and access to information. Nearly 6 billion people do not have high-speed internet, making them unable to fully participate in the digital economy. To deliver universal digital access, we must invest in infrastructure and pursue reforms that bring greater competition to telecommunications markets, promote public-private partnerships, and yield effective regulation.

The Report concludes that the full benefits of the information and communications transformation will not be realized unless countries continue to improve their business climate, invest in people's education and health, and promote good governance.

In countries where these fundamentals are weak, digital technologies have not boosted productivity or reduced inequality. Countries that complement technology investments with broader economic reforms reap digital dividends in the form of faster growth, more jobs, and better services.

The World Bank Group stands ready to help countries pursue these priorities. We are already working with clients to promote competitive business environments, increase accountability, and upgrade education and skills-development systems to prepare people for the jobs of the future.

While people around the world make more than 4 billion Google searches every day, 4 billion people still lack access to the internet. The findings of this Report should be used by all who are working to end extreme poverty and boost shared prosperity. The greatest rise of information and communications in history will not be truly revolutionary until it benefits everyone in every part of the world.

Jim Yong Kim
President
The World Bank Group

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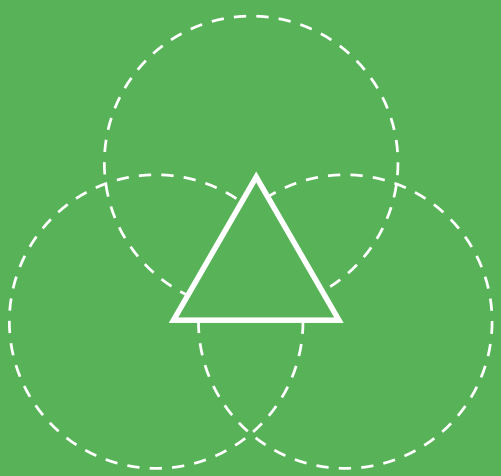


Inclusion

Efficiency

Innovation

OVERVIEW

OVERVIEW

Strengthening the analog foundation of the digital revolution

Digital technologies have spread rapidly in much of the world. Digital dividends—the broader development benefits from using these technologies—have lagged behind. In many instances digital technologies have boosted growth, expanded opportunities, and improved service delivery. Yet their aggregate impact has fallen short and is unevenly distributed. For digital technologies to benefit everyone everywhere requires closing the remaining digital divide, especially in internet access. But greater digital adoption will not be enough. To get the most out of the digital revolution, countries also need to work on the "analog complements"—by strengthening regulations that ensure competition among businesses, by adapting workers' skills to the demands of the new economy, and by ensuring that institutions are accountable.

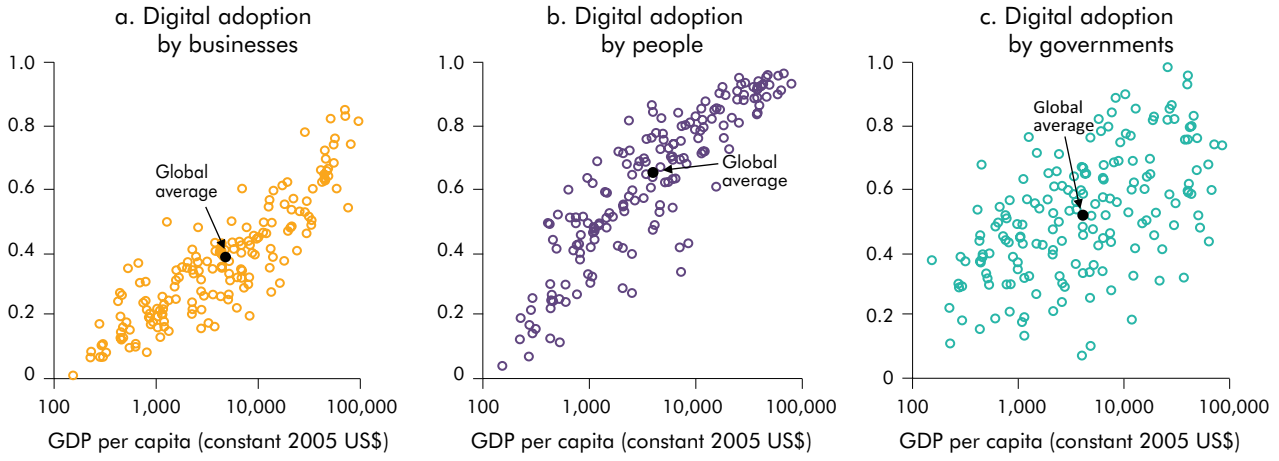
Digital technologies—the internet, mobile phones, and all the other tools to collect, store, analyze, and share information digitally—have spread quickly. More households in developing countries own a mobile phone than have access to electricity or clean water, and nearly 70 percent of the bottom fifth of the population in developing countries own a mobile phone. The number of internet users has more than tripled in a decade—from 1 billion in 2005 to an estimated 3.2 billion at the end of 2015.[1] This means that businesses, people, and governments are more connected than ever before (figure O.1). The digital revolution has brought immediate private benefits—easier communication and information, greater convenience, free digital products, and new forms of leisure. It has also created a profound sense of social connectedness and global community. But have massive investments in information and communication technologies (ICTs) generated faster growth, more jobs, and better services? Indeed, are countries reaping sizable digital dividends?

Technology can be transformational. A digital identification system such as India's Aadhaar, by overcoming complex information problems, helps willing governments to promote the *inclusion* of disadvantaged groups. Alibaba's business-to-business e-commerce site, by significantly reducing coordination costs, boosts *efficiency* in China's economy and arguably the world's. The M-Pesa digital payment platform, by exploiting scale economies from automation, generates significant financial sector *innovation*, with great benefits to Kenyans and others. Inclusion, efficiency, innovation—these are the main mechanisms for digital technologies to promote development.

Although there are many individual success stories, the effect of technology on global productivity, expansion of opportunity for the poor and the middle class, and the spread of accountable governance has so far been less than expected (figure O.2).[2] Firms are more connected than ever before, but global productivity growth has slowed. Digital technologies are changing the world of work, but labor markets have become more polarized and inequality is rising—particularly in the wealthier countries, but increasingly in developing countries. And while the number of democracies is growing, the share of free and fair elections is falling. These trends persist, not because of digital technologies, but in spite of them.

So, while digital technologies have been spreading, digital dividends have not. Why? For two reasons. First, nearly 60 percent of the world's people are still offline

Figure O.1 Digital technologies have spread rapidly in much of the world

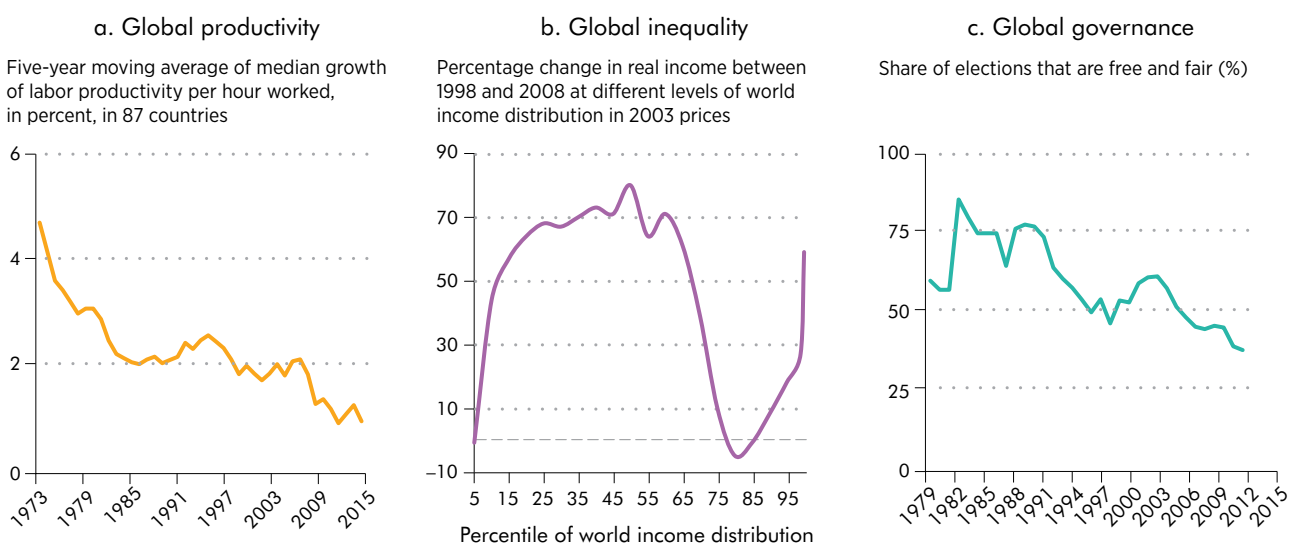


Source: WDR 2016 team. Data at http://bit.do/WDR2016-FigO_1.

Note: The figures show the diffusion of digital technologies across countries as measured by the Digital Adoption Index compiled for this Report and described in detail in chapter 5 of the full Report. GDP = gross domestic product.

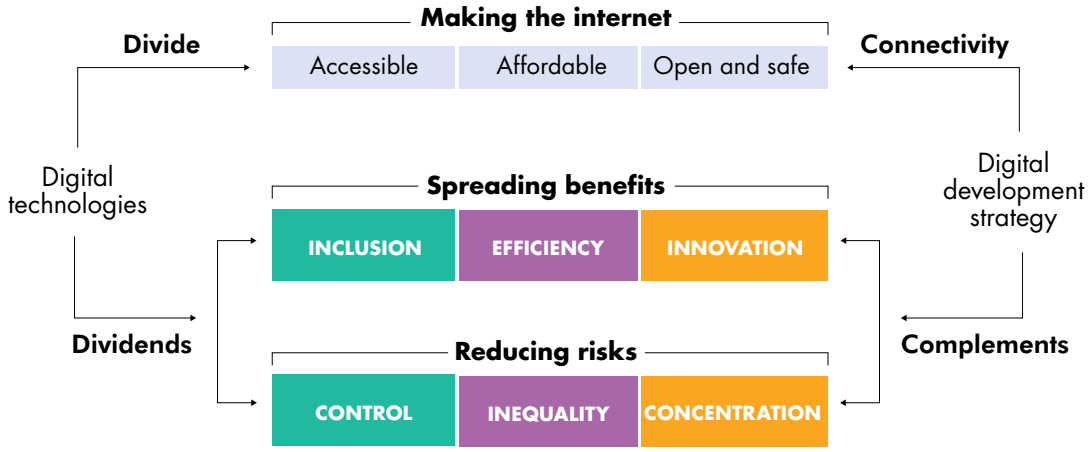
and can't participate in the digital economy in any meaningful way. Second, some of the perceived benefits of digital technologies are offset by emerging risks (figure O.3). Many advanced economies face increasingly polarized labor markets and rising inequality—in part because technology augments higher skills while replacing routine jobs, forcing many workers to compete for low-paying jobs. Public sector investments in digital technologies, in the absence of accountable institutions, amplify the voice of elites, which can result in policy capture and greater state control. And because the economics of the internet favor natural monopolies, the absence of a competitive business environment can result in more concentrated markets, benefiting incumbent firms. Not surprisingly, the better educated, well connected, and more capable have received most of the benefits—circumscribing the gains from the digital revolution.

Figure O.2 The pessimism concerning the global outlook is not because of digital technologies, but in spite of them



Sources: Panel a: Conference Board (various years); WDR 2016 team. Panel b: Lakner and Milanovic 2013. Panel c: Bishop and Hoeffler 2014. Data at http://bit.do/WDR2016-FigO_2.

Figure O.3 Why digital dividends are not spreading rapidly—and what can be done



Source: WDR 2016 team.

To maximize the digital dividends requires better understanding of how technology interacts with other factors that are important for development—what the Report calls "analog complements." Digital technologies can make routine, transaction-intensive tasks dramatically cheaper, faster, and more convenient. But most tasks also have an aspect that cannot be automated and that requires human judgment, intuition, and discretion. When technology is applied to automate tasks without matching improvements in the complements, it can fail to bring broad-based gains. The digital revolution can give rise to new business models that would benefit consumers, but not when incumbents control market entry. Technology can make workers more productive, but not when they lack the know-how to use it. Digital technologies can help monitor teacher attendance and improve learning outcomes, but not when the education system lacks accountability.[3]

What should countries do? Making the internet universally accessible and affordable should be a global priority. The internet, in a broad sense, has grown quickly, but it is by no means universal. For every person connected to high-speed broadband, five are not. Worldwide, some 4 billion people do not have any internet access, nearly 2 billion do not use a mobile phone, and almost half a billion live outside areas with a mobile signal. The unfinished task of connecting everyone to the internet—one of the targets in the recently approved Sustainable Development Goals (SDGs)—can be achieved through a judicious mix of market competition, public-private partnerships, and effective regulation of the internet and telecom sector.

Access to the internet is critical, but not sufficient. The digital economy also requires a strong analog foundation, consisting of *regulations* that create a vibrant business climate and let firms leverage digital technologies to compete and innovate; *skills* that allow workers, entrepreneurs, and public servants to seize opportunities in the digital world; and accountable *institutions* that use the internet to empower citizens. The long-term development impact is by no means definitive, being continuously shaped by the evolution of technology (connectivity) and the country's choice of economic, social, and governance arrangements (complements).[4] Countries that are able to swiftly adjust to this evolving digital economy will reap the greatest digital dividends, while the rest are likely to fall behind (figure O.3 and box O.1).

The triple complements—a favorable business climate, strong human capital, and good governance—will sound familiar—and they should because they are the foundation of economic development. But digital technologies add two important dimensions. First, they raise the opportunity cost of not undertaking the necessary reforms. They amplify the impact of good (and bad) policies, so any failure to reform means falling farther behind those who do reform. With digital technologies, the stakes have risen for developing countries, which have more to gain than high-income countries, but also more to lose. Second, while digital technologies are no shortcut to development, they can be an enabler and perhaps an accelerator by raising the quality of the complements. Online business registries ease market entry for new and innovative firms. Well-designed internet-based training helps workers upgrade their skills. New media platforms can increase citizen participation. And digital enablers—digital finance, digital identification, social media, and open data—spread

Box O.1 Frequently asked questions: The Report at a glance

What is the Report about?
It explores the impact of the internet, mobile phones, and related technologies on economic development. Part 1 shows that potential gains from digital technologies are high, but often remain unrealized. Part 2 proposes policies to expand connectivity, accelerate complementary reforms in sectors beyond information and communication technology (ICT), and address global coordination problems.

What are the digital dividends?
Growth, jobs, and services are the most important returns to digital investments. The first three chapters show how digital technologies help businesses become more productive; people find jobs and greater opportunities; and governments deliver better public services to all.

How do digital technologies promote development and generate digital dividends?
By reducing information costs, digital technologies greatly lower the cost of economic and social transactions for firms, individuals, and the public sector. They promote innovation when transaction costs fall to essentially zero. They boost efficiency as existing activities and services become cheaper, quicker, or more convenient. And they increase inclusion as people get access to services that previously were out of reach.

Why does the Report argue that digital dividends are not spreading rapidly enough?
For two reasons. First, nearly 60 percent of the world's people are still offline and can't fully participate in the digital economy. There also are persistent digital divides across gender, geography, age, and income dimensions within each country. Second, some of the perceived benefits of the internet are being neutralized by new risks. Vested business interests, regulatory uncertainty, and limited contestation across digital platforms could lead to harmful concentration in many sectors. Quickly expanding automation, even of mid-level office jobs, could contribute to a hollowing out of labor markets and to rising inequality. And the poor record of many e-government initiatives points to high failure of ICT projects and the risk that states and corporations could use digital technologies to control citizens, not to empower them.

What should countries do to mitigate these risks?
Connectivity is vital, but not enough to realize the full development benefits. Digital investments need the support of "*analog complements*": regulations, so that firms can leverage the internet to compete and innovate; improved skills, so that people can take full advantage of digital opportunities; and accountable institutions, so that governments respond to citizens' needs and demands. Digital technologies can, in turn, augment and strengthen these complements—accelerating the pace of development.

What needs to be done to connect the unconnected?
Market competition, public-private partnerships, and effective regulation of internet and mobile operators encourage private investment that can make access universal and affordable. Public investment will sometimes be necessary and justified by large social returns. A harder task will be to ensure that the internet remains open and safe as users face cybercrime, privacy violations, and online censorship.

What is the main conclusion?
Digital development strategies need to be broader than ICT strategies. Connectivity for all remains an important goal and a tremendous challenge. But countries also need to create favorable conditions for technology to be effective. When the analog complements are absent, the development impact will be disappointing. But when countries build a strong analog foundation, they will reap ample digital dividends—in faster growth, more jobs, and better services.

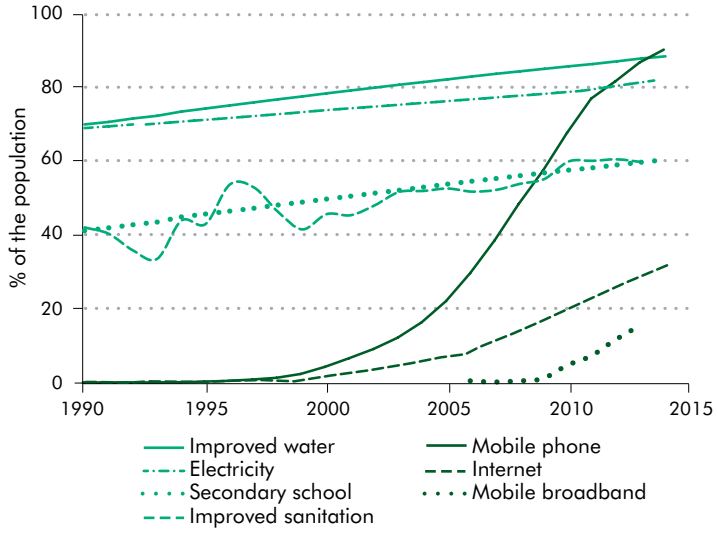
benefits throughout the economy and society, further strengthening the interaction between technology and its complements.

Digital transformations—digital divides

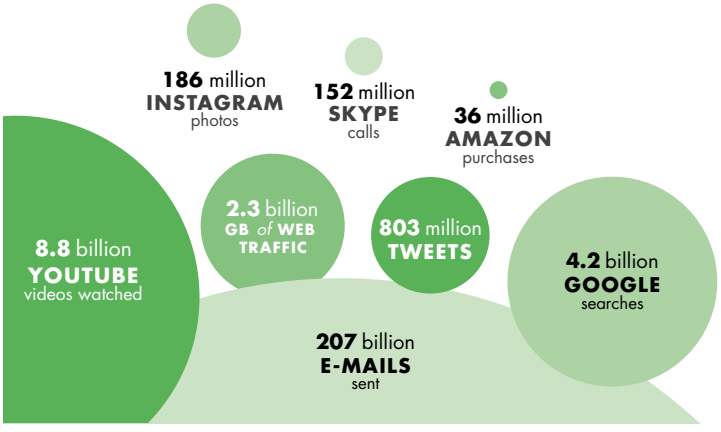
The internet and related technologies have reached developing countries much faster than previous technological innovations. For Indonesia to reap the benefits of steamships took 160 years after their invention and for Kenya to have electricity, 60 years; but for Vietnam to introduce computers, only 15 years. Mobile phones and the internet took only a few years. More households in developing countries own a mobile phone than have access to electricity or improved sanitation (figure O.4, panel a). Greater internet access has led to an explosion in the production and consumption

Figure O.4 Digital transformation in action

a. Digital technologies are spreading rapidly in developing countries



b. A typical day in the life of the internet



Sources: World Development Indicators (World Bank, various years); WDR 2016 team; http://www.internetlivestats.com/one-second/ (as compiled on April 4, 2015). Data at http://bit.do/WDR2016-FigO_4.

Note: In panel a, for some years data for electricity are interpolated from available data. GB = gigabytes.

of information around the world (figure O.4, panel b). But while the internet has reached almost all countries quickly, the intensity of its use has been lower in poorer countries—in large part because it has not spread as widely within those countries. And despite many great examples of the uses of new technologies in developing countries, advanced economies have been using them even more effectively.[5]

Connected people

On average, 8 in 10 individuals in the developing world own a mobile phone, and the number is steadily rising. Even among the bottom fifth of the population, nearly 70 percent own a mobile phone. The lowest mobile penetration is in Sub-Saharan Africa (73 percent), against 98 percent in high-income countries. But internet adoption lags behind considerably: only 31 percent of the population in developing countries had access in 2014, against 80 percent in high-income countries. China has the largest number of internet users, followed by the United States, with India, Japan, and Brazil filling out the top five. The world viewed from the perspective of the number of internet users looks more equal than when scaled by income (map O.1)—reflecting the internet's rapid globalization.

Connected businesses

Internet adoption has increased across businesses in all country income groups. Nearly 9 of 10 businesses in high-income OECD (Organisation for Economic Co-operation and Development) countries had a broadband internet connection in 2010–14, compared with 7 for middle-income countries and 4 for low-income countries. But adoption rates for more sophisticated technologies such as secure servers, enterprise network, inventory management, and e-commerce are much lower in most developing countries.

Connected governments

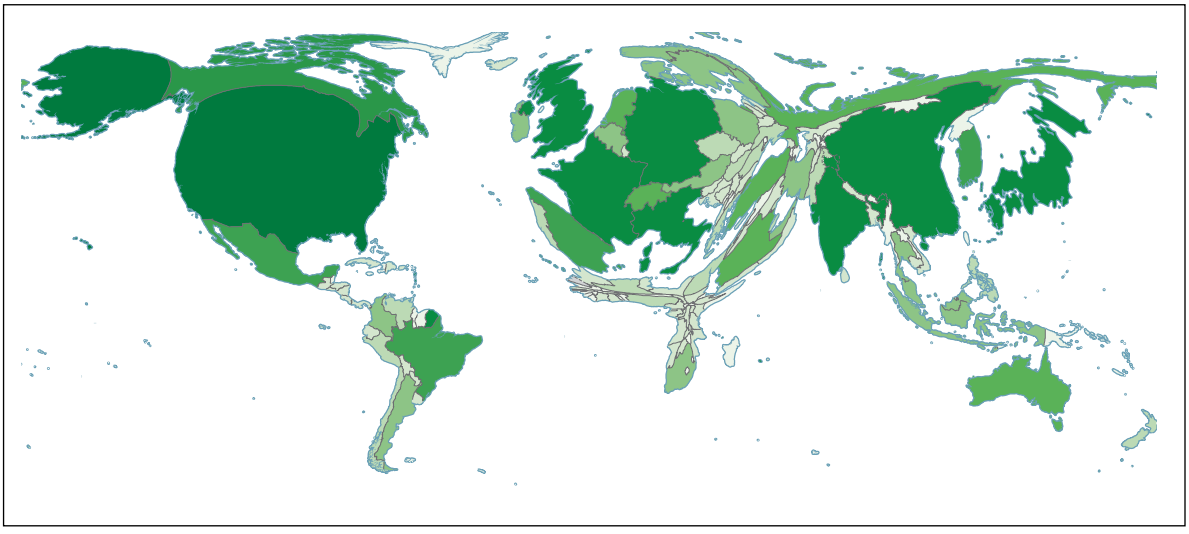
Governments are increasingly going digital, and a greater share of government jobs in developing countries is ICT-intensive than in the private sector. By 2014, all 193 member states of the United Nations (UN) had national websites: 101 enabled citizens to create personal online accounts, 73 to file income taxes, and 60 to register a business. For the most common core government administrative systems, 190 member states had automated financial management, 179 used such systems for customs processing, and 159 for tax management. And 148 of them had some form of digital identification, and 20 had multipurpose digital identification platforms. So far, developing countries have invested more in automating back-office functions than in services directed at citizens and businesses.

The divide in digital access and use persists

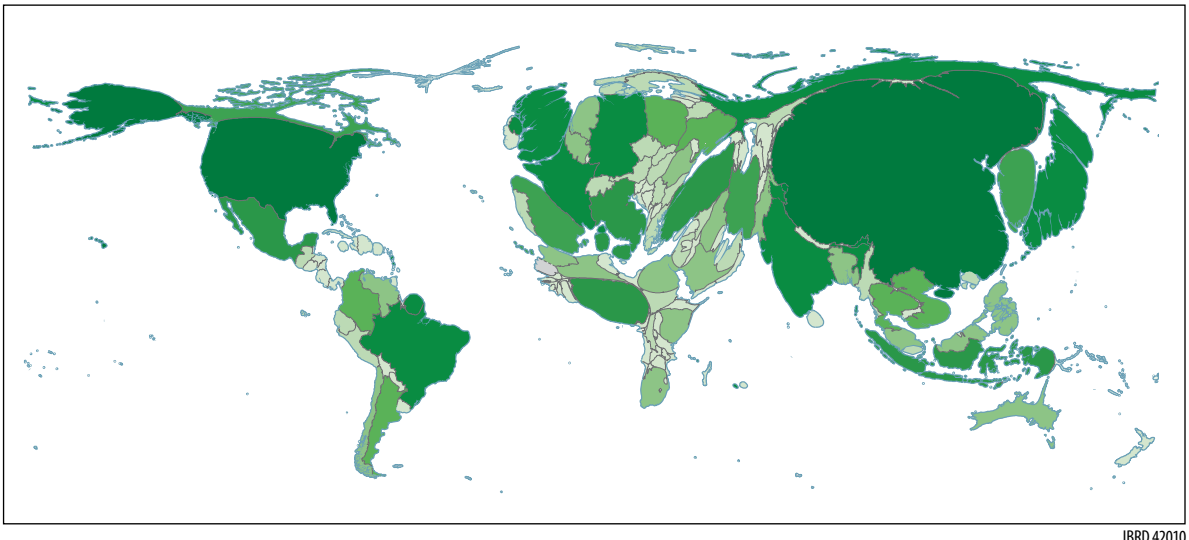
The lives of the majority of the world's people remain largely untouched by the digital revolution. Only around 15 percent can afford access to broadband internet. Mobile phones, reaching almost four-fifths of the world's people, provide the main form of internet access in developing countries. But even then, nearly 2 billion people do not own a mobile phone, and nearly 60 percent of the world's population has no access to the internet. The world's offline population is

Map O.1 The internet is more evenly spread than income

a. Based on national income, 2014



b. Based on internet population, 2014



IBRD 42010

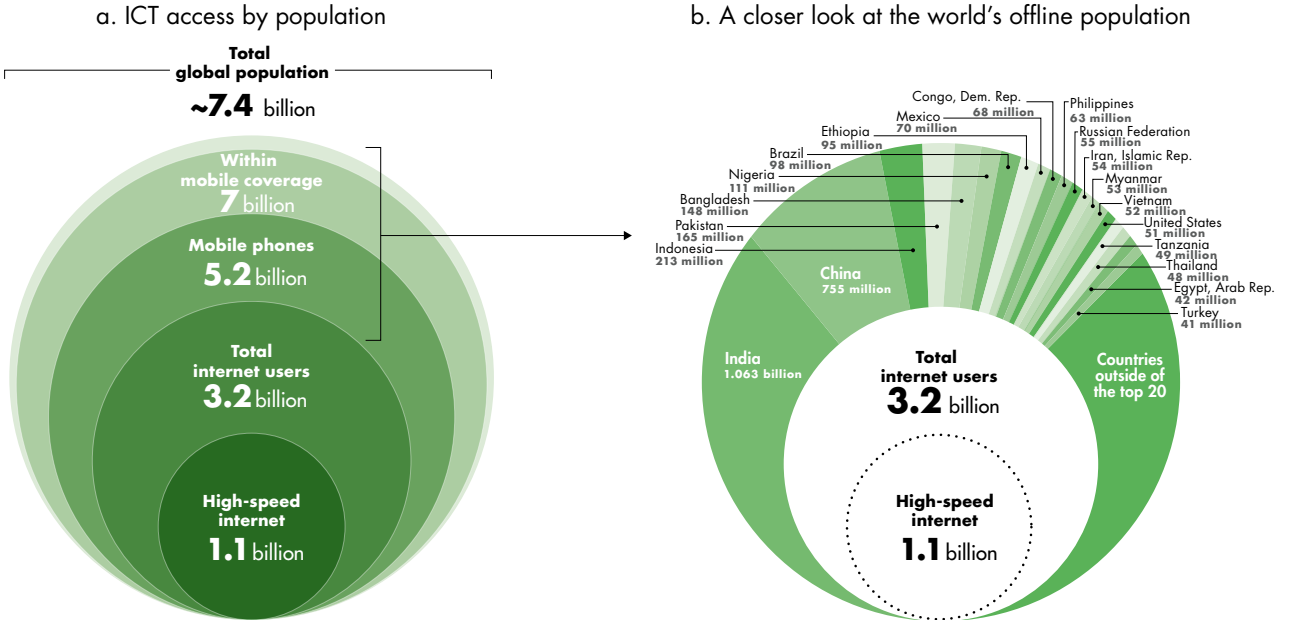
Source: World Bank. Data at http://bit.do/WDR2016-MapO_1.

Note: Countries' sizes are rescaled in proportion to national income and internet population. The darker the shade, the higher the national income (panel a; GDP at market exchange rates) and the higher the internet population (panel b).

mainly in India and China, but more than 120 million people are still offline in North America (figure O.5).

The digital divide within countries can be as high as that between countries. Worldwide, nearly 21 percent of households in the bottom 40 percent of their countries' income distribution don't have access to a mobile phone, and 71 percent don't have access to the internet. Adoption gaps between the bottom 40 percent and the top 60 percent and between rural and urban populations are falling for mobile phones but increasing for the internet. In Africa, the digital divide across demographic groups remains considerable (figure O.6, panel a). Women are less likely than men to use or own digital technologies. Gaps are even larger between youth (20 percent) and those more than 45 years old (8 percent).

Figure O.5 The internet remains unavailable, inaccessible, and unaffordable to a majority of the world's population



Sources: World Bank 2015; Meeker 2015; ITU 2015; GSMA, https://gsmaintelligence.com/; UN Population Division 2014. Data at http://bit.do/WDR2016-FigO_5.

Note: High-speed internet (broadband) includes the total number of fixed-line broadband subscriptions (such as DSL, cable modems, fiber optics), and the total number of 4G/LTE mobile subscriptions, minus a correcting factor to allow for those who have both types of access. 4G = fourth generation; DSL = digital subscriber line; ICT = information and communication technology; LTE = Long Term Evolution.

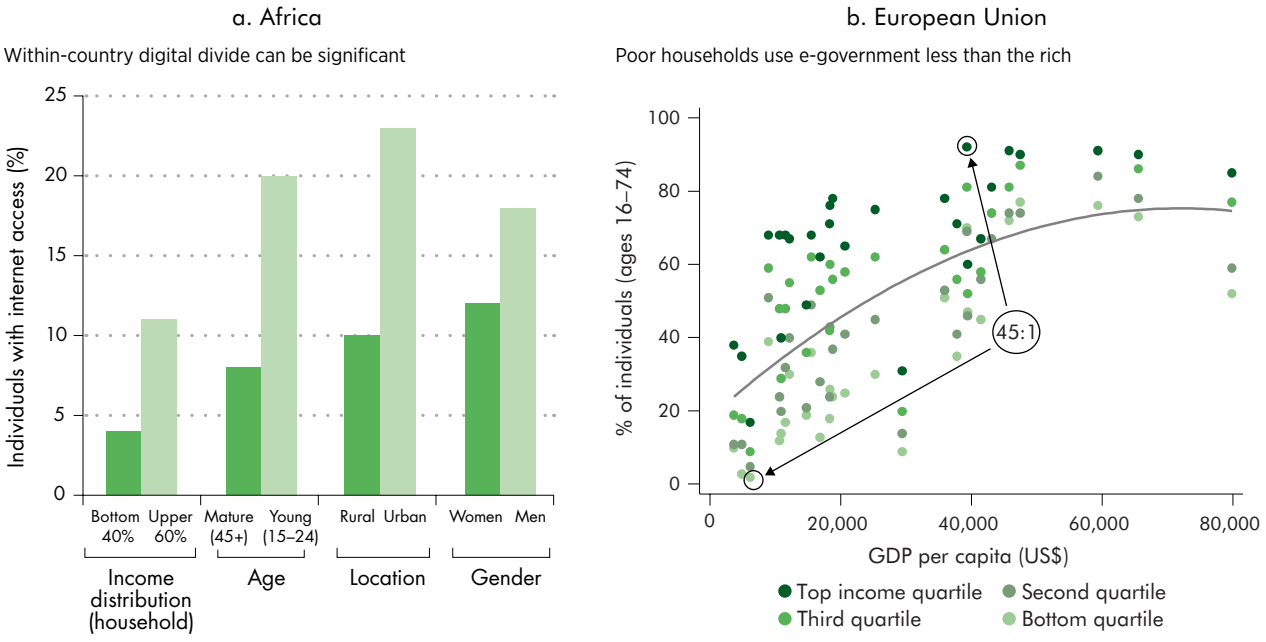
The increased connectivity has had limited effect in reducing information inequality. For example, there are more contributions to Wikipedia from Hong Kong SAR, China, than from all of Africa combined, despite the fact that Africa has 50 times more internet users.[6] The amount of information published on the web, and its origin, often corresponds to what one sees in the offline world as well. For instance, 85 percent of the user-generated content indexed by Google comes from the United States, Canada, and Europe, similar to the share of global scientific journals originating in these countries. In fact, the information produced and consumed in the digital economy has little bearing on the number of users of digital technologies. Given that nearly one-fifth of the world's population is illiterate, the spread of digital technologies alone is unlikely to spell the end of the global knowledge divide.

Countries that have bridged the digital-access divide often face a new divide in digital capabilities. In the European Union (EU), businesses are more likely than citizens to use the internet to interact with the government. Citizens use e-government mostly for getting information and not for transacting with government. And their use of e-government is highly uneven—citizens in the top 20 percent of income in the most connected EU country are 45 times more likely to use e-services than those in the bottom 20 percent of income in the least connected EU country (figure O.6, panel b). Within countries, greater e-government use by individuals is associated with education, employment, urban residence, being male, and broadband access.

How the internet promotes development

Digital technologies have dramatically expanded the information base, lowered information costs, and created information goods. This has facilitated searching, matching, and sharing of information and contributed to greater organization and collaboration among economic agents—influencing how firms operate, people seek opportunities, and citizens interact with their governments. The changes are not limited to economic transactions—they also influence the participation of women in the labor force, the

Figure O.6 The digital divide in access is high in Africa, and the divide in capability is high in the European Union

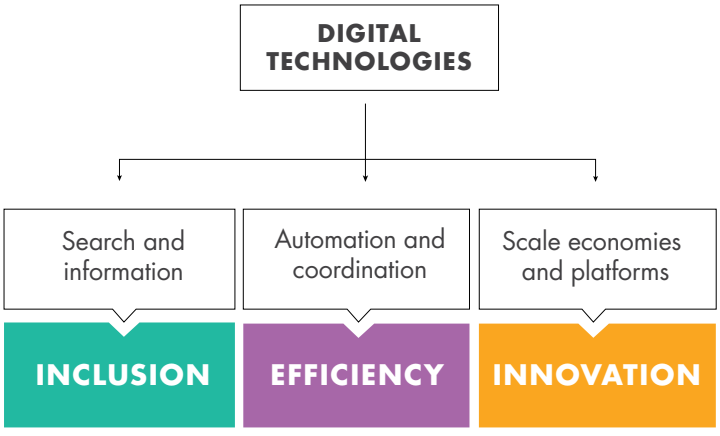


Sources: WDR 2016 team, based on data from Research ICT Africa (various years), ITU, and Eurostat (EC, various years). Data at http://bit.do/WDR2016-FigO_6.

Note: For more details see figure 2.4 in the full Report.

ease of communication for people with disabilities, and the way people spend their leisure. By overcoming information barriers, augmenting factors, and transforming products, digital technologies can make development more inclusive, efficient, and innovative (figure O.7 and box O.2). Spotlight 1 in the full Report explores the links between these three mechanisms in the broader economic literature.

Figure O.7 The internet promotes development through three main mechanisms



Source: WDR 2016 team.

The internet promotes inclusion

Before the internet arrived, some transactions were so expensive that a market for them did not exist. Two types of transactions fall into this category. First is when two parties to a potentially beneficial transaction simply didn't know about each other and faced exorbitantly high search and information costs. Second is when one party had a lot more information than the other. In the economics literature, such situations are known as information asymmetries between buyers and sellers, and in the absence of trust and transparency, many transactions do not take place.

By reducing the cost of acquiring information and making more information available transparently, digital technologies can make new transactions possible.[7] Consider a poor farmer who cannot access credit because the lender has no way to assess creditworthiness. Or a small firm that cannot connect with a potential buyer in another country and does not know whether to trust a new business partner. Or a freelancer willing to perform small tasks for a fee. Or a homeowner looking to rent her spare room to local visitors. Or remote or marginalized population groups who fall outside the reach of the services that governments provide. In all these cases, a fundamental

Box O.2 e-commerce with Chinese characteristics: Inclusion, efficiency, and innovation in Taobao villages

The dynamic growth and rapid spread of e-commerce in China is best illustrated by the Shaji phenomenon. The economy of Dongfeng village in Shaji town (Jiangsu Province) shifted from pig farming in the 1980s to plastic waste recycling in the 1990s. In 2006, a migrant from the village returned to open an online shop to sell simple furniture. His success encouraged other villagers to do likewise, and by the end of 2010, the village had 6 board processing factories, 2 metal parts factories, 15 logistics and shipping companies, and 7 computer stores serving 400 households engaged in online sales throughout China and even in neighboring countries. Shaji was one of the first "Taobao villages"—named after an online shopping platform run by the Alibaba Group—where at least 10 percent of households are engaged in online commerce.[a] The Taobao villages, and the rise of e-commerce in China more generally, illustrate how the internet promotes inclusion, efficiency, and innovation.

Inclusion. While the economies of China's coastal urban areas have grown rapidly over the last three decades, rural and western parts of the country have lagged behind. But China's large investments in rural connectivity are beginning to pay off. More than 90 percent of villages will have fixed broadband access by the end of 2015. Online commerce has allowed producers in towns and villages to participate in the national and even global economy. At the end of 2014, there were more than 70,000 merchants in 200 Taobao villages, and many more in other rural areas. Most of the stores are small, with an average of 2.5 employees. About one-third of owners are female, and one-fifth were previously unemployed. About 1 percent are persons with disabilities. One of Alibaba's top "netpreneurs," confined to a wheelchair after an accident, built a thriving online livestock business.

Efficiency. Besides the Taobao e-commerce site for consumers, Alibaba and other Chinese firms operate business-to-business platforms. They facilitate intra- and inter-industry trade in China's already efficient production sector, as well as exports. They also make it easier for foreign firms to sell in China. Consumers benefit from greater selection and convenience on online retail sites. Online trade has not only helped raise rural incomes but also made shopping more efficient. Purchasing power in rural areas is only about one-third that in cities, but the aggregate consumption of China's 650 million rural residents is vast, contributing to the national goal of moving from an export- and investment-driven economy to one that is more consumption based. And the boom in online trade has spawned numerous logistics companies that provide quick delivery—sometimes by bicycle in towns and villages.

Innovation. Taobao and other e-commerce platforms are examples of innovation generated by the economies of scale that emerge when transaction costs drop drastically. Since these platforms are highly automated, fees can be kept low, and operations are often financed by advertising alone. Some problems cannot easily be solved solely by automation, such as creating trust in the market and preventing fraud. Online ratings, escrow services, and conflict resolution mechanisms address them. One of the most valuable assets Alibaba and other e-commerce operators accumulate is data. Each transaction contributes to better knowledge about the economy and consumer behavior. This information supports new business lines, such as extending credit to small firms based on automated evaluations of creditworthiness. This can also advance financial inclusion. In early 2015, for instance, Alibaba's Ant Financial teamed up with the International Finance Corporation to expand credit to female entrepreneurs in China.

Sources: WDR 2016 team, based on information from the China State Information Center, China Association for Employment Promotion, and Alibaba company reports.

a. http://www.alizila.com/report-taobao-villages-rural-china-grow-tenfold-2014.

information problem makes it difficult to make a deal or a match. Mobile phone records, business-to-business e-commerce, the sharing economy, online reputation mechanisms, and digital identification systems all help to overcome these information barriers. While they make the market more efficient, the biggest benefit seems to be their market creation effects: expanding trade, creating jobs, and increasing access to public services—and thus promoting inclusion.[8]

The internet promotes efficiency

Perhaps the largest impact has been on transactions that existed before the arrival of the internet but are now quicker, cheaper, or more convenient to carry out.

This mechanism operates in two ways. First, the dramatic decline in the price of digital technologies has led businesses and governments to replace existing factors—labor and non-ICT capital—with ICT capital and to automate some of their activities. Airlines use online booking systems to fill planes. Supermarkets substitute cashiers with automated checkout counters. Manufacturers use real-time inventory and supply chain management systems. And governments invest in information management systems and offer online services for a wide range of tasks—from issuing drivers' licenses to filing taxes.

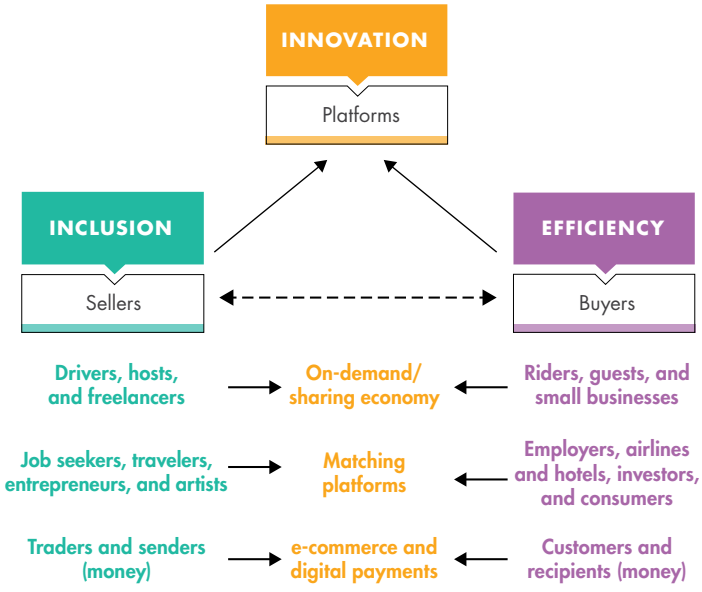
Second, digital technologies augment the factors not substituted and make them more productive. They help managers to better supervise their workers, politicians to monitor the service providers, and workers to use technology to become more productive, thus raising the returns to their human capital. By streamlining tasks and raising the productivity of existing factors, the internet can greatly increase economic efficiency across firms, workers, and governments.

The internet promotes innovation

The extreme case of efficiency is when transactions are executed automatically, without human input, and transaction costs fall to essentially zero. This is the realm of the "new economy," such as search or e-commerce platforms, digital payment systems, e-books, streaming music, and social media. The fixed cost of building the platform may be large, but the marginal cost of carrying out another transaction or adding another user is tiny. This gives rise to increasing returns to scale, which stimulate new business models and provide a major advantage to online firms competing with their offline counterparts. The zero marginal cost attracts new sellers and buyers to the firm's platform, creating virtuous network effects, where the benefit to a buyer increases as more sellers join in, and vice versa. An auction site attracts more bidders the more the sellers use it, and a search engine learns and becomes more useful the more searches are performed. Scale and zero marginal costs also explain why many of the social network sites have become the preferred vehicles for social mobilization and political protests. By enabling almost frictionless communication and collaboration, the internet can support new delivery models, encourage collective action, and accelerate innovation.

The 2016 WDR presents many examples of how the internet promotes inclusion, efficiency, and innovation. In the internet economy the three mechanisms often operate together. So the one-to-one mapping in figure O.7 simplifies a more complex reality.

Figure O.8 Many digital transactions involve all three mechanisms and a two-sided market



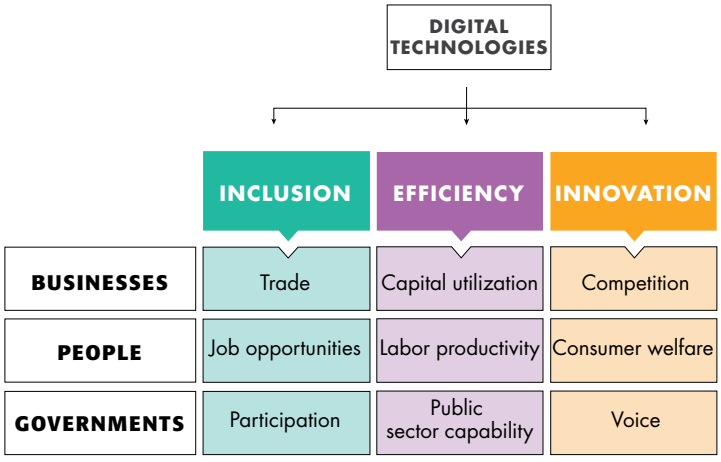
Source: WDR 2016 team.

Many internet businesses or services use a platform or "two-sided market" model. The platforms match buyers with sellers or a service user with a provider. In a ride sharing service, the platform automatically matches drivers and passengers (innovation), the driver takes advantage of a flexible income-earning activity not otherwise accessible (inclusion), and the passenger benefits from greater convenience and often lower prices (efficiency). Online crowdfunding, job matching, room sharing, and music sites operate similarly (figure O.8).

The dividends: Growth, jobs, and service delivery

The benefits of digital technologies filter throughout the economy (figure O.9). For businesses, the internet promotes inclusion of firms in the world economy by expanding trade, raises the productivity of capital, and intensifies competition in the marketplace, which in turn induces innovation. It brings opportunities to households by creating jobs, leverages human capital, and produces consumer surplus. It enables citizens to access public services, strengthens government capability, and serves as a platform for citizens to tackle collective action problems. These benefits are neither automatic nor assured, but in numerous instances digital technologies can bring significant gains.

Figure O.9 How the three mechanisms apply to businesses, people, and governments



Source: WDR 2016 team.

The internet can lead to more trade, better capital use, and greater competition

The ICT sector is a fairly modest part of the overall economy. Its share in GDP is around 6 percent in OECD member countries and considerably less in developing countries (figure O.10, panel a). In the United States, home to 8 of the world's 14 largest technology companies by revenue, the contribution of the ICT sector to GDP is around 7 percent. The corresponding number for Ireland is 12 percent—a country that does not boast its own Silicon Valley, but attracts many foreign firms through its competitive business environment and favorable tax rates. In Kenya, which hosts one of the largest ICT sectors in Africa, the value added share of ICT services in GDP was 3.8 percent in 2013.

The contribution of ICT capital to GDP growth has been fairly constant over the past two decades. In high-income countries, it has fallen from 0.7 percentage points in 1995–99 to 0.4 percentage points in 2010–14 (figure O.10, panel b). In developing countries, the contribution of ICT capital to GDP growth has been fairly modest—around 15 percent of growth—reflecting lower digital adoption. With rapid diffusion of digital technologies into developing countries, this number could rise in the future. In addition, the indirect contributions of ICT capital to economic growth, through improvements in total factor productivity (TFP), could be large as well, although rigorous evidence linking the two is still missing.

The rapid adoption of digital technologies in the economy has meant that its benefits are widely dispersed and its indirect growth impacts difficult to estimate. Like energy or transport, the internet has become an essential part of a country's infrastructure—and a factor of production in almost any activity in a modern economy. Isolating the impact of digital technologies is therefore difficult at an aggregate level. Firm-level analysis provides a more reliable picture.[9] The internet enables many small firms to participate in global trade, thus leading to more inclusion; it makes existing capital more productive, raising efficiency; and by stimulating competition, it encourages innovation.

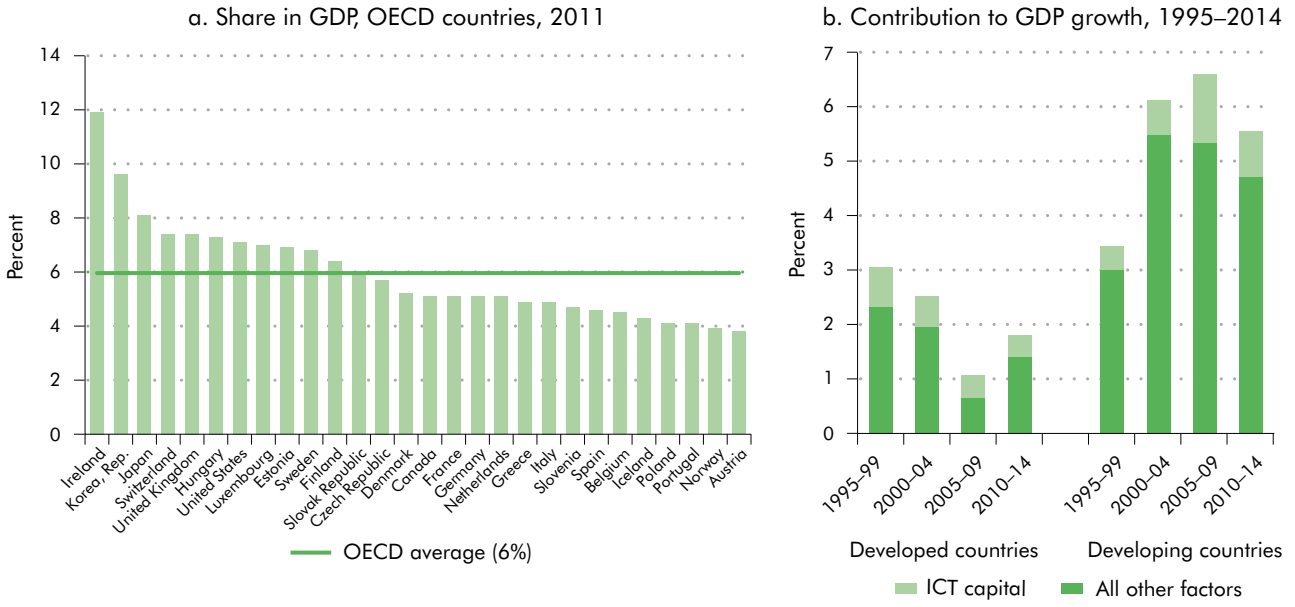
Expanding trade

The internet enables more products to be exported to more markets, often by newer and younger firms. A 10-percent increase in internet use in the exporting country is found to increase the number of products traded between two countries by 0.4 percent. A similar increase in internet use of a country pair increases the average bilateral trade value per product by 0.6 percent.[10] Firms selling on eBay in Chile, Jordan, Peru, and South Africa are younger than firms in the offline markets.[11] In Morocco, rural artisans, some of them illiterate, sell globally through the Anou crafts platform. At the other end of the spectrum, businesses trade on global e-commerce sites such as Alibaba's in an online market that could reach more than US$6 trillion over the next five years. Online platforms overcome trust and information problems through feedback and rating systems and by offering escrow and dispute resolution mechanisms. Easier trade of intermediate products encourages further "unbundling" of production processes, not just in the markets for goods but also for services.[12] Firms in India, Jamaica, and the Philippines have captured a share of these global markets for services that range from traditional back-office services to long-distance online tutoring.

Improving capital utilization

Perhaps the greatest contribution to growth comes from the internet's lowering of costs and thus from raising efficiency and labor productivity in practically all economic sectors. Better information helps companies make better use of existing capacity, optimizes inventory and supply chain management, cuts downtime of capital equipment, and reduces risk. In the airline industry, sophisticated reservation and pricing algorithms increased load factors by about one-third for U.S. domestic flights between 1993 and 2007. The parcel delivery company UPS famously uses intelligent routing algorithms to avoid left turns, saving time and about 4.5 million liters of petrol per year. Many retailers now integrate their suppliers in

Figure O.10 The size of the ICT sector and its contribution to GDP growth is still relatively modest



Sources: OECD 2014; Conference Board Total Economy Database, January 2014; WDR 2016 team. Data at http://bit.do/WDR2016-FigO_10.

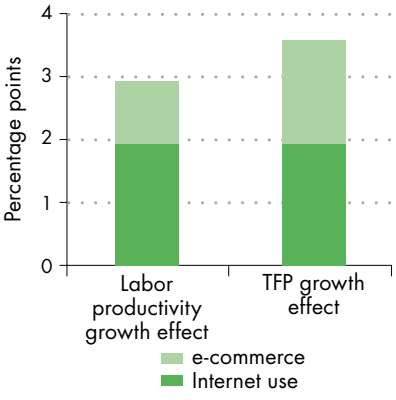
Note: GDP = gross domestic product; ICT = information and communication technology; OECD = Organisation for Economic Co-operation and Development.

real-time supply chain management to keep inventory costs low. Vietnamese firms using e-commerce had on average 3.6 percentage point higher TFP growth than firms that did not use it (figure O.11). Chinese car companies that are more sophisticated users of the internet turn over their inventory stocks five times faster than their less savvy competitors. And Botswana and Uruguay maintain unique ID and trace-back systems for livestock that fulfill requirements for beef exports to the EU, while making the production process more efficient.

Advancing competition

When fully automated internet-based services drive marginal transaction costs to zero, the consequences for market structure are somewhat ambiguous. Low marginal costs imply large economies of scale, which favor natural monopolies. In the offline world, such sectors—for example, electricity production—often require some form of regulation to protect consumer interests. But the characteristics of internet-based services could also encourage competition. Price-comparison websites, for example, should reduce prices for consumers, even though the evidence shows that price dispersion on the internet persists, in part because companies are getting better at price discrimination—offering different prices to different consumers based on search history, geographic location, or other information collected about buyers.

Figure O.11 Vietnamese firms using e-commerce have higher TFP growth, 2007–12



Source: Nguyen and Schiffbauer 2015 for the 2016 WDR. Data at http://bit.do/WDR2016-FigO_11.

Note: For more details see figure 1.9 in the full Report. TFP = total factor productivity.

The internet can also facilitate market entry. Internet firms can start and scale up quickly with relatively little staffing or capital investment. Cloud computing—the leasing of computing and data storage

services—reduces startup costs and allows firms to add capacity as the need arises, which also reduces risk to investors. Although many internet firms seem to operate in separate markets, most if not all compete with offline firms. Instant messaging apps compete with telecoms, search engines and social media sites compete with traditional media for advertising revenue, e-commerce firms compete with brick-and-mortar firms, and mobile money competes with traditional banks. Innovations triggered by this online-offline competition generally benefit consumers, especially when offline markets are distorted. Transport service companies such as Uber, Lyft, Olacabs, and Didi-Kuaidi Dache have disrupted taxi markets that tend to be overregulated with restricted entry and high prices. Similarly, TransferWise and Xoom have reduced regulatory rents in the financial sector and cut the prices of international currency transfers by up to 90 percent. In Uganda, eKeebo allows independent or amateur chefs to provide and share home-cooked meals, circumventing restaurant licenses.

The internet supports job creation and makes workers more productive

People have an enormous desire to communicate and connect. The personal welfare gain from having access to digital technology is clearly great. Does it also increase people's economic opportunities? People certainly use mobile phones and the internet more for social purposes than for professional ones. But an emerging literature also indicates that people realize tangible economic benefits. Quantifying these benefits is difficult, but qualitative evaluation of the evidence shows that benefits accrue most to those already better off (table O.1). Those who have the skills to leverage technology will have an advantage. But even the poor benefit to some extent through indirect job creation and better access to work and markets. As governments and the private sector get better at tailoring digital services to the poor, those gains will likely increase.

Creating jobs

The number of direct jobs created by digital technologies is fairly modest, but the number enabled by it can be large. In developing countries, the ICT sector accounts for only about 1 percent of the workforce on average: less than 0.5 percent in Bolivia and Ghana, and just under 2 percent in Colombia and Sri Lanka. In OECD countries, about 3–5 percent of the employment is in this sector. Instagram, a photo sharing app, had just 13 employees in 2012 when it was bought by Facebook for US$1 billion. Facebook had 5,000 employees at the time—compared with 145,000 at Kodak at its peak in photographic film in the 1990s. Yet Facebook's market value is several times what Kodak's was back then.[13] ICT jobs, however, tend to pay well, and each high-tech job generates 4.9 additional jobs in other sectors in the United States.[14] In Kenya, the M-Pesa digital payment system creates additional income for more than 80,000 agents. And China's State Information Center estimates that the recent boom in the country's e-commerce sector has created 10 million jobs in online stores and related services, about 1.3 percent of the country's employment. New opportunities for entrepreneurship and self-employment are also growing rapidly in the digital economy.

The internet's ability to reduce transaction costs increases opportunities for people who face barriers in finding jobs or productive inputs. This promotes inclusion for women, for persons with disabilities,

Table O.1 Benefits of digital technologies for workers and consumers: A scorecard

Channel	Impact so far		Potential impact	
	Poor	Nonpoor	Poor	Nonpoor
Creating jobs				
In the ICT sector and occupations	Negligible	L	Negligible	L
In sectors that use ICT	L	M	L	M
Increasing worker productivity				
Increasing returns to human capital	L	M	L	H
Connecting people to work and markets	M	H	H	H
Benefiting consumers				
Increasing consumer surplus	M	H	H	H

Source: WDR 2016 team.

Note: Poor refers to the bottom 20 percent of the welfare distribution. The differential impact summarizes the discussion in chapter 2 in the full Report and is a qualitative assessment of the evidence. ICT = information and communication technologies; L = low; M = medium; H = high.

Box O.3 Bridging the disability divide through digital technologies

Over 1 billion people around the world have disabilities, and 80 percent of them live in developing countries. Persons with disabilities face barriers to communicate, interact, access information, and participate in civic activities. Digital technologies are helping overcome some of these barriers. Technology enables multiple means of communication—voice, text, and gestures—to access information and engage with others. Voice recognition, magnification, and text-to-speech functionality benefit persons with visual, cognitive, learning, and mobility disabilities. Short message service (SMS), instant messaging, telephone relay, and video captions reduce communication barriers for persons with hearing and speech disabilities. Hands-free navigation and gesture-controlled interfaces assist persons with severe mobility impairments in using digital devices. But the mere existence of technology is an insufficient condition to bridge the gaps in the socioeconomic inclusion of persons with disabilities. A supportive ecosystem is needed to drive the implementation of accessible digital technologies.

Source: Raja 2015, for the WDR 2016.

and for people in remote areas (box O.3). Impact outsourcing brings internet-based jobs to the poor and vulnerable. The government of the Indian state of Kerala set up the Kudumbashree project to outsource information technology services to cooperatives of women from poor families; 90 percent of the women had not previously worked outside the home. Samasource and Rural Shores link clients in the United States and the United Kingdom with workers in Ghana, Haiti, India, Kenya, and Uganda. Of global online workers on the Elance freelancing platform, part of Upwork, 44 percent are women, and many wish to balance work and family life. Among respondents to a survey of online workers for this Report, the ability to work flexible hours from home is considered the greatest advantage of online work.

Increasing labor productivity

For the economy as a whole, the most profound impact of the internet on individuals is that it makes workers more productive. By handing off routine and repetitive tasks to technology, workers can focus on activities with higher value. Judicious use of massive open online courses (MOOCs) or online teaching tools like Khan Academy lets teachers spend more time fostering discussion and working with students who fall behind. Researchers can dedicate more time thinking and innovating rather than searching for information or duplicating other people's work. Managers can work more easily with teams across borders. These benefits are largest for the higher skilled. In fact, there has never been a better time to be a high-skilled worker, as the returns to education remain high—almost 15 percent for an additional year of tertiary education in developing countries.

The biggest gains from digital technologies for the poor are likely to come from lower information and search costs. Technology can inform workers about prices, inputs, or new technologies more quickly and cheaply, reducing friction and uncertainty.[15] That can eliminate costly journeys, allowing more time for work and reducing risks of crime or traffic accidents (box O.4).[16]

Using technology for information on prices, soil quality, weather, new technologies, and coordination with traders has been extensively documented in agriculture (see sector focus 1 in the full Report). In Honduras, farmers who got market price information via short message service (SMS) reported an increase of 12.5 percent in prices received.[17] In Pakistan, mobile phones allow farmers to shift to more perishable but higher return cash crops, reducing postharvest losses from the most perishable crops by 21–35 percent.[18] The impacts of reduced information asymmetries tend to be larger when learning about information in distant markets or among disadvantaged farmers who face more information constraints.[19]

Increasing the consumer surplus

Where the internet has led to a full automation of services, many jobs have been lost—few travel agents, booksellers, or music store employees are left. But these same dynamics have been a boon to consumers. There are new digital goods and services—such as e-books, digital music, and search engines. And the internet has transformed existing ones—such as taxi

Box O.4 Digital dividends and the bottom billion

The poor benefit from digital technologies, but only modestly in relation to the true potential. Nearly 7 of 10 people in the bottom fifth of the population in developing countries own a mobile phone, improving their access to markets and services. In rural Niger, agricultural price information obtained through mobile phones reduces search costs by 50 percent.[a] In rural Peru, access to mobile phones boosted household real consumption by 11 percent between 2004 and 2009, reducing poverty by 8 percentage points and extreme poverty by 5.4 percentage points.[b]

The poor can benefit from digital technologies even when they don't own a mobile phone or a computer. For example, a digital ID, by giving millions of poor people an official identity, increases their access to a host of public and private services. In Narma Dih—a village in Bihar, India, with no electricity or all-weather roads—poor farmers benefit from digitally enabled agricultural extension services from Digital Green, an NGO (nongovernmental organization) that trains farmers using locally produced how-to videos.[c]

Yet the poor are capturing only a modest share of the digital dividends. While a majority of the poor have a mobile phone, they can't access or afford the internet. In Latin America, fewer than 1 in 10 poor households is connected to the internet. In the Central African Republic, one month of internet access costs more than 1.5 times the annual per capita income. Even mobile phones are expensive: the median mobile phone owner in Africa spends over 13 percent of her monthly income on phone calls and texting. And many poor lack the basic literacy and numeracy skills needed to use the internet. In Mali and Uganda, about three-quarters of third-grade children cannot read. In Afghanistan and Niger, 7 of 10 adults are illiterate.

In advanced economies the poor face the prospects of stagnant wages and fewer opportunities, as they are increasingly forced to compete with those displaced by automation. Digital technologies can also exacerbate socioeconomic disparities. For example, the internet voting on municipal budget proposals in the state of Rio Grande do Sul in Brazil and citizen engagement initiatives such as Uganda's U-report show that the new users are more likely to be male, young, university educated, and wealthy—those already better off before the internet's advent.[d]

Rapid technological progress will increasingly enable the poor to afford and use many digital services. But their ability to reap dividends from these investments will be largely determined by providing the analog complements.

Source: WDR 2016 team.

a. Aker and Mbiti 2010.
b. Beuermann, McKelvey, and Vakis 2012.
c. Chomitz 2015.
d. Spada and others 2015; Berdou and Lopes 2015.

and hospitality services, health, education, and retail. This has increased the variety of goods and services available, including those for leisure. The internet thus enhances consumer welfare, but in ways that are hard to measure.

People's perceptions are that digital technologies have certainly made them better off. In 12 countries surveyed in Africa, 65 percent of people believe that their family is better off because they have mobile phones, whereas only 20 percent disagree (14.5 percent not sure).[20] And 73 percent say mobile phones help save on travel time and costs, with only 10 percent saying otherwise. Two-thirds believe that having a mobile phone makes them feel more safe and secure.

Some studies have attempted to quantify the economic value of these gains. A McKinsey survey of consumers in France, Germany, the Russian Federation, Spain, the United Kingdom, and the United States in 2010 found that a household is willing to pay an average of US$50 a month for services it now gets for free on the internet. Time-use data in the United States suggest that the median individual gains more than US$3,000 annually from the internet. In Estonia, digital signatures saved 20 minutes per transaction. And a study of the time costs of searching for information shows that the average online search tends to be 15 minutes faster, the results are more accurate and relevant, and the experience more enjoyable than offline search in a library. On average, people might realize a consumer surplus as high as US$500 a year from such services, adding up to vast benefits when aggregated over all users.

The internet can make governments more capable and responsive

Governments provide services that are typically nontradable, often lack scale, and are not subject to market competition. Raising efficiency in the public

sector is thus challenging, and one might expect the internet to bring large benefits in public service provision. There are indeed many examples where the internet has raised the capabilities of the public sector. Better tools for communicating with citizens and providing information also allow greater participation—through inclusion in government assistance programs, or feedback to and monitoring of public officials. And the internet helps citizens to connect online and organize for collective action in order to put pressure when government performance falls short of people's expectations.

Expanding participation

Lack of identity is an impediment for poor people to exercise their basic democratic and human rights. Where civil registration systems are weak or nonexistent, many of the poor are simply not counted. Digital identification can help overcome barriers to participation. Many countries have introduced general-purpose digital identity (ID) schemes or specific systems for elections or to manage postconflict transfers—with numerous benefits, including making the public sector more efficient. Nearly 900 million Indians have been issued digital IDs in the past five years, which they are using to open bank accounts, monitor attendance of civil servants, and identify recipients of government subsidies. Nigeria's e-ID revealed 62,000 public sector "ghost workers," saving US$1 billion annually. But the most important benefit may be in better integrating marginalized or disadvantaged groups into society.

Digital technologies also enable the poor to vote by providing them with robust identification and by curtailing fraud and intimidation through better monitoring. Mobile phones enable citizens to report instances of violence and voter intimidation, improving electoral participation. In Mozambique, SMS messages allowed citizens to report electoral irregularities and increased voter turnout by 5 percentage points.[21] Ushahidi and Uchaguzi are crowdsourced applications that report and map election violence in Kenya. By multiplying the sources of information, the internet can reduce the risk of media capture and make censorship difficult.

Improving public sector capability

The internet raises efficiency and productivity through automation and data-driven management. Almost all countries have tried to automate tax and customs administration, as well as budget preparation, execution, and accounting. Results have been mixed. E-filing reduces tax compliance costs, and one-stop computerized service centers and online portals have improved service efficiency. E-procurement helped India and Indonesia inject more competition into the process by increasing the probability that the winning bidder comes from outside the project's region. This also improved the quality of infrastructure. But a majority of public sector digital technology projects fail to achieve the project objectives, resulting in considerable fiscal waste.[22]

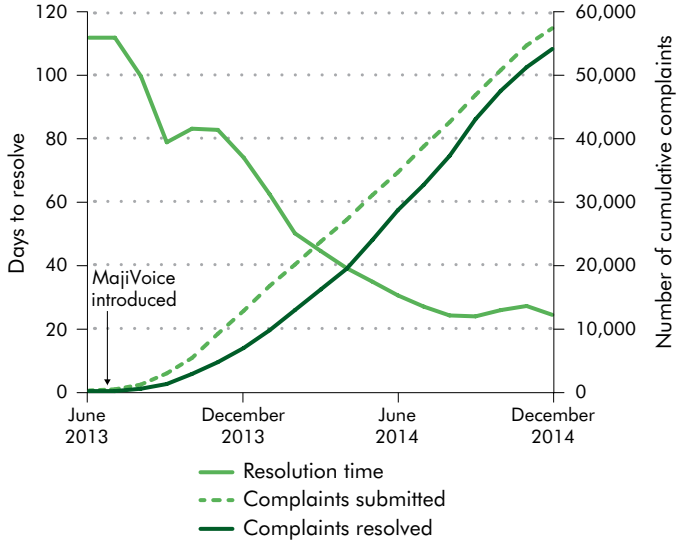
Digital technologies can also improve management by monitoring the performance of workers. A small but growing impact evaluation literature reports generally positive effects of technology-based monitoring on worker absenteeism when combined with other institutional reforms.[23] In Uganda, where teacher absenteeism is estimated at 27 percent, head teachers use mobile phones to record attendance and transmit data to a central database that generates weekly reports. Combined with incentive pay for teachers tied to attendance, the program reduced absenteeism by 11 percentage points. The internet also provides real-time data for better planning and management of service facilities. In Ghana, Kenya, Tanzania, and Zambia, health workers use mobile phones to report counterfeit drugs and stock-outs. Aggregated in a central database and geographically mapped, this information helps administrators address drug and equipment shortages.

Providing citizens the opportunity to give specific feedback quickly has helped improve performance in many instances. Mobile-phone apps like SeeClickFix and FixMyStreet in the United States and the United Kingdom let users report potholes, graffiti, and illegal dumping. Governments can report back on fixes, closing the feedback loop. Internet call centers enabling citizens to report problems and track the status of their requests are now standard in Barcelona, Buenos Aires, Muscat, Rio de Janeiro, Seoul, and Ulaanbaatar, to name a few cities. The Nairobi water company uses MajiVoice, and one of the electricity supply companies in the Dominican Republic, EDE Este, uses a similar system to receive complaints, track their resolution through an automated workflow, and regularly update citizens on progress. When implemented well, citizens eagerly take up the opportunity to give feedback, and resolution time declines (see figure O.12).

Advancing voice

Governments, particularly those in digitally advanced countries like Estonia, the Republic of Korea, and Singapore, are beginning to take advantage of data analytics and digital platforms for faster, more informed, and integrated policy making. The internet also opens new avenues for participatory democracy. Iceland has experimented with crowdsourcing its constitution, and Brazil and Estonia have explored

Figure O.12 More complaints were resolved more quickly in the Nairobi water utility after the introduction of digital customer feedback

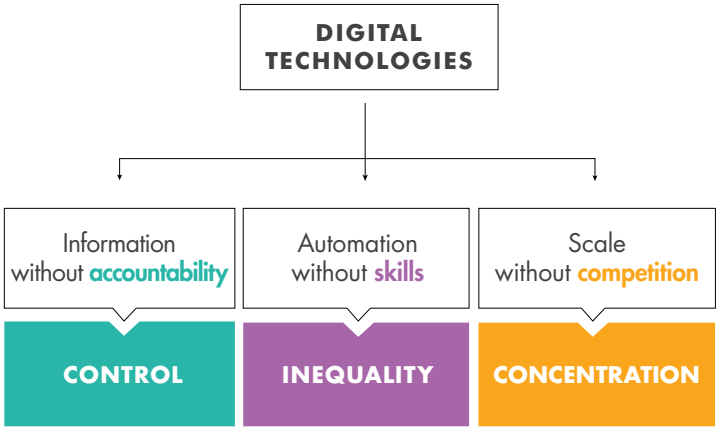


Source: World Bank 2015. Data at http://bit.do/WDR2016-FigO_12.

Note: For more details see figure 3.11 in the full Report.

participatory lawmaking. By dramatically lowering the cost of communication and coordination, social media can overcome the traditional barriers to citizen collective action. A growing empirical literature has also shown that cellphones and the use of Twitter and Facebook aided protests during the Arab Spring in the Arab Republic of Egypt,[24] antiwar demonstrations in the United States,[25] and citizen mobilization across Africa.[26]

Figure O.13 Without strong analog complements, opportunities may turn into risks



Source: WDR 2016 team.

The risks: Concentration, inequality, and control

So, the internet can be an effective force for development. But as the Report documents, the benefits too often are not realized, and the internet sometimes makes persistent problems worse. Why? The key insight is that for complex occupations, business activities, or public services, the internet usually can make only a portion of tasks cheaper, more efficient, or more convenient through automation. Another portion still requires capabilities that humans possess in abundance but computers do not. Many traditional tasks of an accountant or bank teller are now automated, such as making calculations or processing withdrawals. Others require complex reasoning or socioemotional skills, such as designing tax strategies or advising clients. Likewise, many public services involving provision of information or routine permissions can be automated. But others, such as teaching or policing, need a high degree of human discretion, tacit knowledge, and judgment.

Many problems and failures of the internet surface when digital technology is introduced but the important analog complements remain inadequate. What are these complements? The main ones are regulations that ensure a high degree of competition, skills that leverage technology, and institutions that are accountable (figure O.13).

- When the internet delivers scale economies for firms but the business environment inhibits competition, the outcome could be excessive ***concentration*** of market power and rise of monopolies, inhibiting future innovation.
- When the internet automates many tasks but workers do not possess the skills that technology augments, the outcome will be greater ***inequality***, rather than greater efficiency.
- When the internet helps overcome information barriers that impede service delivery but governments remain unaccountable, the outcome will be greater ***control***, rather than greater empowerment and inclusion.

The interplay between internet investments and reforms in complementary areas is at the core of policy debates about technology impacts. A 2008 study by Claudia Goldin and Lawrence Katz,[27] drawing on earlier work by Jan Tinbergen, framed these dynamics in the labor market as a "race between education and technology." As technology progresses, some skills become obsolete. Workers must acquire new

skills that help them become more productive with the help of that technology. Adjustment takes time and will be painful for many, but this is how economies progress. The sections that follow discuss risks and complements in the private sector, in labor markets, and in the public sector.

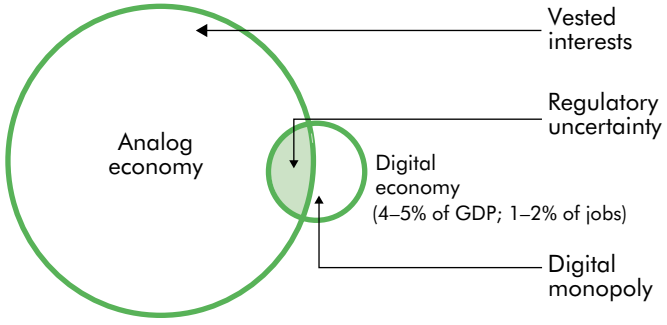
Growing concentration: The nexus between regulations and technology

One of the main mechanisms for the internet to promote economic growth is competition. Information flows increase and speed up so that customers have more choice and can compare prices more easily. Firms that use technology more effectively will do well and force others to follow suit. There is considerable evidence that this is happening throughout the economy, but three potential problems could emerge.

First, while the internet has spread quickly in the private sector of some countries, adoption among non-ICT firms has been slow in other countries. Larger, fast-growing, skill-intensive, export-oriented, and urban firms tend to use digital technologies more. The causes of these differences are not well understood. Differences in adoption rates may simply reflect differences in income, sector characteristics, and management capabilities, but they could also be due to barriers to adoption (figure O.14). One possibility is high import duties for digital goods and services in some countries. Another is market distortions and protections that allow firms to maintain profits without threats from more innovative entrants. For example, firms in Mexico that faced competition from China increased the number of computers per employee and became twice as likely to use the internet for purchasing as those that didn't face significant competition.

Second, when online businesses enter the turf of their offline counterparts, disruption can be great, and regulators are often unsure whether or how to react. Recently, "on-demand economy" firms Uber and Airbnb have challenged established taxi and hotel industries. Their platform business model is scalable and global and has spawned numerous local imitators. In cities from Paris to Delhi to Beijing, the reaction has been a scramble by offline incumbents to keep these new competitors out, usually by appealing to regulators to enforce established sector regulations such as the knowledge of the city (in the case of London cabbies) or insurance requirements. This can be a valid appeal when regulations protect public safety and ensure minimum service levels. But these new models often succeed because they enter heavily distorted markets with virtual monopolies or oligopolies. The risk of allowing underregulated entrants into a market must therefore be weighed against the benefits to consumers from lower prices and greater convenience.

Figure O.14 Factors explaining the lower adoption of digital technologies by businesses



Source: WDR 2016 team.

The third potential risk comes from the dominant position of many online platforms and internet intermediaries. Economic history shows that firms are tempted to exploit a dominant position. Large internet firms may be no exception. The economics of the internet favor natural monopolies,[28] and some platforms now dominate their markets. They enjoy such high profits that they can quickly capture new markets by buying out competitors or developing a rival service; local startups, including those in developing countries, are left with tiny niche markets. Some of the biggest internet firms now face scrutiny from regulators. Google, which captures almost one-third of global digital advertising revenue,[29] has been investigated for preferential placement of its own products, exploiting third-party content, and exclusionary practices in its placement of advertising.[30] Amazon, the largest sales platform for book publishers, has used its market power to enforce its pricing policies. Safaricom, operating the M-Pesa payment system, resisted the entry of competing service providers. The vast amount of identifiable personal information that many of these companies collect raises further challenges (box O.5).

It is too early to tell whether these problems will diminish the overall economic benefits from the internet or be mitigated by the sector's low entry costs and rapid technological change. Consumers have generally benefited from the internet-based business models of existing and new firms. Markets are extremely dynamic, so many advantages from scale or moving first may be temporary. And greater size

Box O.5 What Facebook "Likes" reveal—the convenience-privacy trade-off

When economists such as George Stigler and Richard Posner wrote about privacy and economics in the early 1980s, they raised many issues debated today, but at that time the "storage and retrieval of information, and its accurate dissemination, [were] often extremely expensive."[a] Today, an enormous collection of identifiable information is making service delivery more efficient and more relevant. Service providers can better target or price their products based on known characteristics and preferences. Search engines provide more relevant search results. Health and auto insurers can better price premiums with verifiable information about exercise or driving behavior. And governments can use data systems to reduce the bureaucratic burden for citizens. In Estonia's e-government system, citizens never have to provide the same information twice.

The problem is that few people know how these large amounts of data are collected and used—and who controls them. Users are not always aware of and providers often don't tell what information is collected. The secret snooping by governments can be for legitimate law enforcement reasons, but sometimes violates laws and rights, as the Edward Snowden revelations about spying by the security agencies of the United States, the United Kingdom, and others have shown. A consequence has been a new "data nationalism," where countries are demanding that data about their residents be stored within their territory or favoring domestic technology that may be inferior or more expensive, but is trusted more.

Data collectors often sell the data to others. One data broker assembled an average of 1,500 pieces of information about more than half a billion consumers worldwide from information people provided voluntarily on various websites. But even easily accessible data such as Facebook "Likes" can predict sensitive characteristics including "sexual orientation, ethnicity, religious and political views, personality traits, intelligence, happiness, use of addictive substances, parental separation, age, and gender."[b] And smartphone sensors can infer a user's "mood, stress levels, personality type, bipolar disorder, demographics (e.g., gender, marital status, job status, age), smoking habits, overall wellbeing, progression of Parkinson's disease, sleep patterns, happiness, levels of exercise, and types of physical activity or movement."[c]

The risks? Cybercrime such as identity theft when data stored insecurely fall into the wrong hands. Discrimination when customers are charged a higher premium or interest rate, or denied a job based on erroneous information they can't easily correct. Persistence of dated information that denies protection from embarrassing but irrelevant information or a second chance, which prompted Europe's "right to be forgotten" ruling. And perhaps most important, reduced trust and thus suboptimal use of the internet. These concerns vary across societies. Fifty-eight percent of Nigerians and 57 percent of Indians believe private information on the internet is very secure, but only 18 percent of French and 16 percent of German respondents do.[d]

Sources: WDR 2016 team, based on Peppet 2014; Castro 2013; *Economist* 2014; Kosinski, Stillwell, and Graepel 2013.

a. Posner 1981.
b. Kosinski, Stillwell, and Graepel 2013.
c. See Peppet (2014) for individual references.
d. CIGI and Ipsos 2014.

allows large firms to provide services and products at low cost or free of charge, and their high profits fuel investments in research and development (R&D). At the same time, it is clear that competition and market structure on the internet are in many ways not so different from the offline world. Policies need to ensure that all innovative companies can enter markets and compete on equal terms. Otherwise, the economic performance between firms of different size and in different countries could diverge further and contribute to similarly divergent performance of national economies.

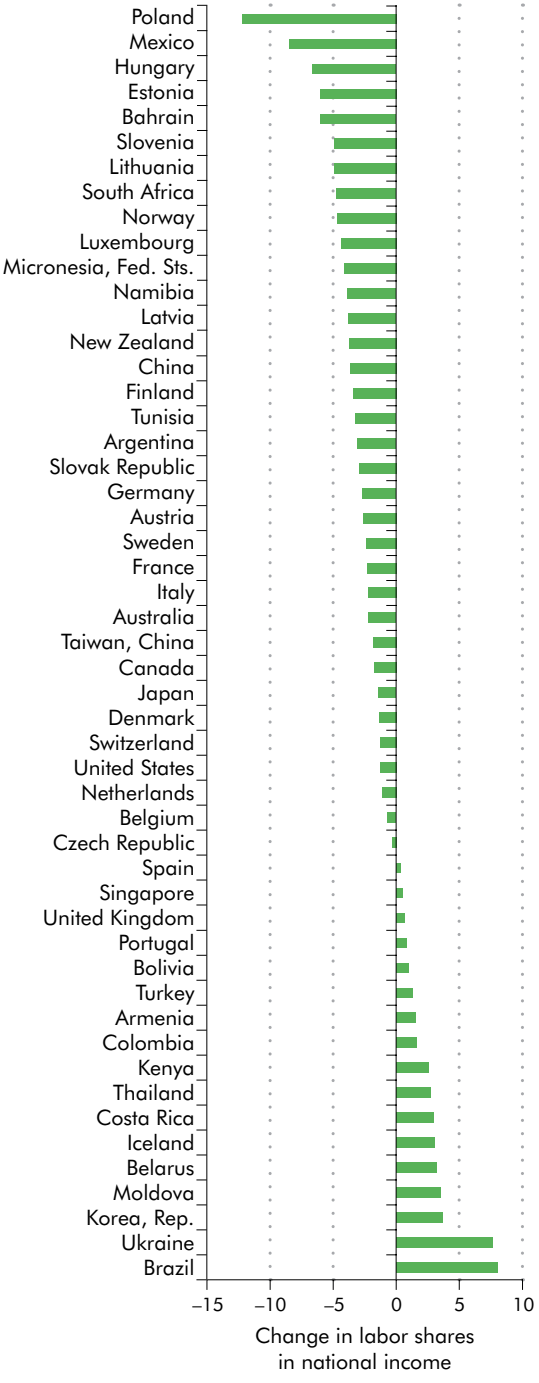
Rising inequality: The race between skills and technology

If the internet and related technologies promote growth, how are the gains shared in the labor market? While digital technologies raise productivity and enhance overall welfare, labor market disruptions can be painful and can result in higher inequality. Global trends provide some indication. One is that the share of national income that has gone to labor, especially routine labor, has fallen quite sharply in many developing countries—though Brazil and Ukraine are exceptions (figure O.15).[31] Inequality has

Figure O.15 Labor shares of national income are falling in many countries, including some developing countries

Trends in labor shares in output since 1975

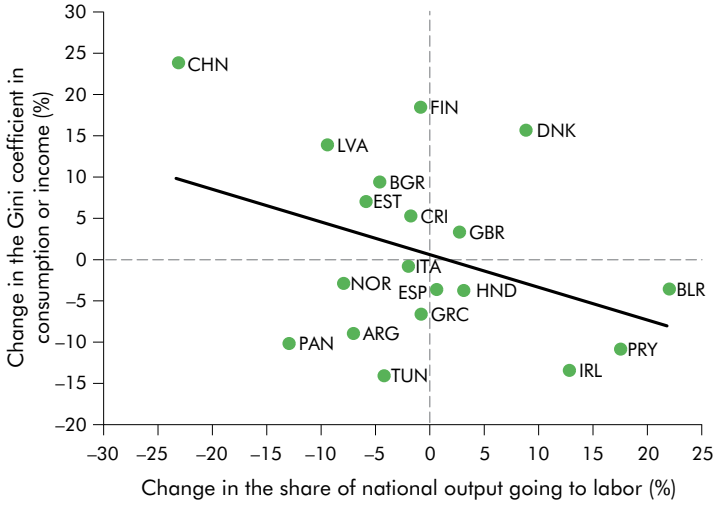
percentage points every 10 years



Source: Karabarbounis and Neiman 2013. Data at http://bit.do/WDR2016-FigO_15.

Figure O.16 Falling labor shares in national income are associated with rising inequality

Change in Gini coefficient vs. growth in labor share in national income, 1995–2010



Source: Eden and Gaggl 2015, for the WDR 2016. Data at http://bit.do/WDR2016-FigO_16.

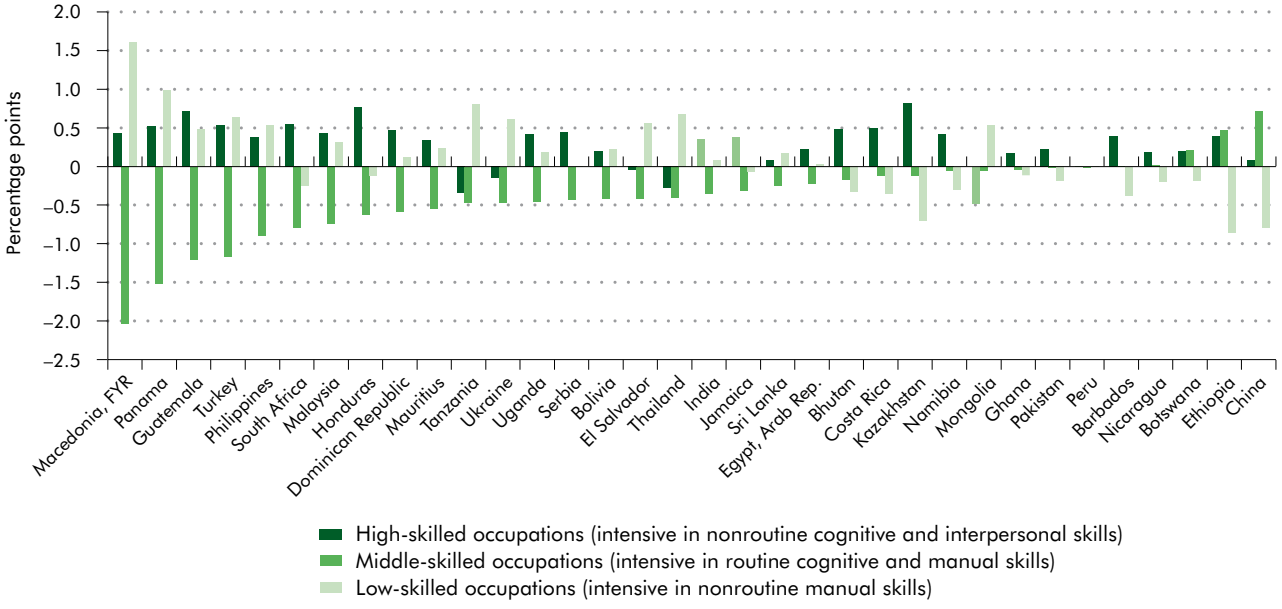
increased more where this shift in incomes toward capital and away from labor has been higher (figure O.16). A number of recent studies have linked technological change to this rising inequality (see chapter 2 in the full Report).

A related trend is the polarization—or "hollowing out"—of the labor market, not only in advanced economies, but increasingly also in many developing countries. The share of employment in high-skilled occupations is up, as is the share of low-skilled jobs. The share of middle-skilled employment, in contrast, is down in most developing countries for which detailed data are available (figure O.17). And these types of jobs are often near the top of the income distribution in low-income countries, as in Africa. A notable exception to these global trends is China, where growing mechanization in agriculture has led to a (perhaps temporary) increase in routine, mid-level labor. Exceptions also include some countries rich in natural resources and commodity exporters, which include several countries in Central Asia and Latin America.

What explains all this? Machines can increasingly perform routine tasks more quickly and cheaply than humans, and much of what is considered nonroutine today—such as translation, insurance underwriting, or even medical diagnostics—computers might do just as well tomorrow. Unlike previous technological transformations such as the mechanization of

Figure O.17 The labor market is becoming more polarized in many developing countries

Annual average change in employment share, circa 1995–circa 2012



Sources: WDR 2016 team, based on ILO KILM (ILO, various years); the International Income Distribution database (I2D2; World Bank, various years); National Bureau of Statistics of China (various years). Data at http://bit.do/WDR2016-FigO_17.

Note: The figure displays changes in employment shares between circa 1995 and circa 2012 for countries with at least seven years of data. The classification follows Autor 2014. High-skilled occupations include legislators, senior officials and managers, professionals, and technicians and associate professionals. Middle-skilled occupations comprise clerks, craft and related trades workers, plant and machine operators and assemblers. Low-skilled occupations refer to service and sales workers and elementary occupations. For more details see figure 2.15 in the full Report.

agriculture or the automation of manufacturing, the internet affects well-paying white-collar jobs even more than blue-collar jobs.

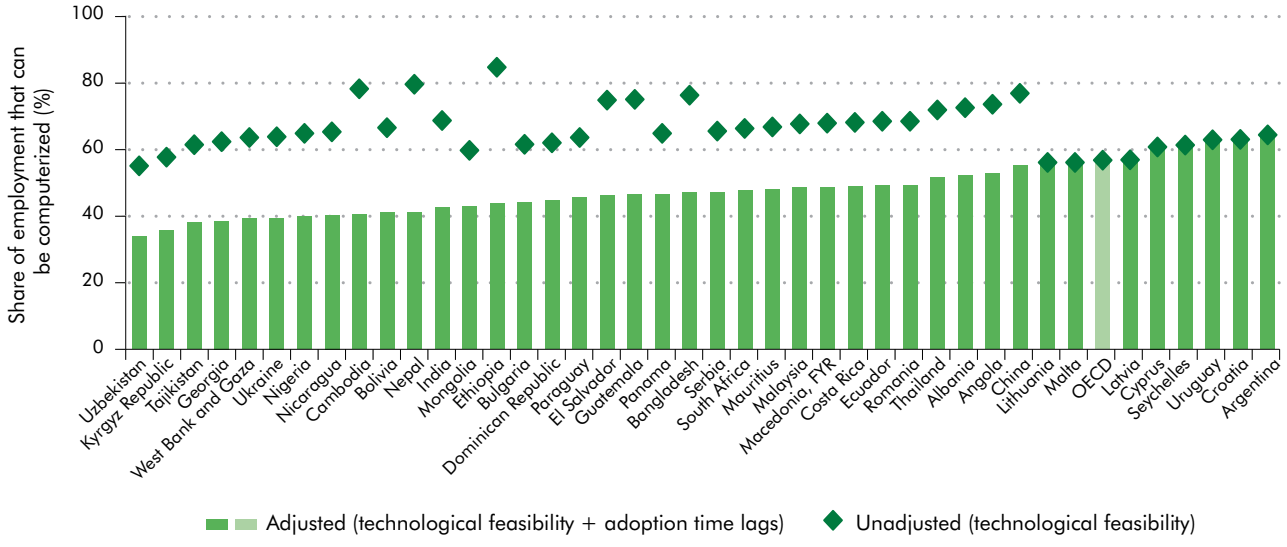
Some mid-level workers will have additional skills that allow them to switch to better-paid nonroutine occupations in which technology tends to augment human capital and make skilled workers more productive. These workers will gain from technological disruption. In developing countries, returns to education are highest among those with tertiary education, and they are higher and rising faster in ICT-intensive occupations.[32] Those who do not have such skills will need to seek work in lower-skilled, nonroutine occupations, such as janitorial services, hospitality, or personal care. Demand for such services could increase, but perhaps not enough to prevent downward wage pressure as the available workforce in these sectors grows. These dynamics are consistent with the rising returns to education and income inequality we see in many countries.

The implications for developing countries depend on the pace of technological disruption. The share of occupations that could experience significant automation is actually higher in developing countries than in more advanced ones, where many of these jobs have already disappeared (figure O.18). But it will likely take longer in lower-income countries. Most of them are still fairly low-tech, with only about one-third of urban jobs in a sample of developing countries using any ICTs at work. And wage rates are still low, with a larger share of manual nonroutine labor, so investments in technology will be less profitable for firms. This does not mean, however, that lower-income countries need not pay attention to these trends. Most important, even without significant employment shifts, the nature of jobs is changing toward skills that remain hard for technology to emulate: that is, advanced cognitive and socioemotional skills. The policy response, besides rethinking social protection systems, is better and more responsive education and training—areas where reforms take many years to pay off.

It is important to keep in mind the historical perspective that job displacement and job losses from technological change are an integral part of economic progress. It is precisely rising productivity—as technology replaces some human labor but augments the skills of remaining and new workers—that generates

Figure O.18 From a technological standpoint, two-thirds of all jobs are susceptible to automation in the developing world, but the effects are moderated by lower wages and slower technology adoption

Estimated share of employment that is susceptible to automation, latest year



Source: WDR 2016 team. See figure 2.24 in the full Report for more details. Data at http://bit.do/WDR2016-FigO_18.

Note: For more details see figure 2.24 in the full Report. OECD = Organisation for Economic Co-operation and Development.

growth and frees human and financial resources for deployment in sectors with higher returns. It also reduces the need for humans to do physically hard, repetitive, or dangerous work. Such trends will be welcome in countries that are rapidly aging or where the population is declining, or in professions where skills are in short supply. Telemedicine and automated diagnostics, for instance, allow medical experts to serve many more people, even remotely in areas with a shortage of doctors.

And fears of "technological unemployment" go back to the industrial revolution. Even such thinkers as the economist John Maynard Keynes and the writer Isaac Asimov submitted to this fallacy. Keynes, in the 1930s, predicted 15-hour workweeks by the end of the 20th century, and Asimov, in a 1964 essay, expected that one of the most pressing problems for humanity by 2014 would be boredom "in a society of enforced leisure." Yet over the centuries, economies have adapted to massive changes in labor markets—the largest by far, being the shift out of agriculture. In 1910, there were 12 million farmworkers in the United States. One hundred years later, there were only 700,000 in a population more than three times larger. Still, nobody can predict the full impact of technological change in coming decades, which may be faster and broader than previous ones. What is clear, however, is that policy makers face a race between technology and education, and the winners will be those who encourage skill upgrading so that all can benefit from digital opportunities.

Engendering control: The gap between institutions and technology

The internet was expected to usher in a new era of accountability and political empowerment, with citizens participating in policy making and forming self-organized virtual communities to hold government to account. These hopes have been largely unmet. While the internet has made many government functions more efficient and convenient, it has generally had limited impact on the most protracted problems—how to improve service provider accountability (principal-agent problems) and how to broaden public involvement and give greater voice to the poor and disadvantaged (collective action problems).

Whether citizens can successfully use the internet to raise the accountability of service providers depends on the context. Most important is the strength of existing accountability relationships between policy makers and providers, as discussed in the 2004 *World Development Report, Making Services Work for Poor People*. An examination of seventeen digital engagement initiatives for this Report finds that of nine cases in which citizen engagement involved a partnership between civil society organizations (CSOs) and government,

Table O.2 Classifying the digital citizen engagement cases

Case	Location	Additional offline mobilization	CSO partners with government	Collective feedback	Impact	
					Citizen uptake	Government response
Por Mi Barrio	Uruguay	✓	✓		L	H
I Change My City	India	✓	✓		M	H
Lungisa	South Africa	✓	✓		L	H
Pressure Pan	Brazil	✓		✓	H	M
Rappler	Philippines	✓	✓	✓	H	M
Change.org	World	✓		✓	H	M
U-report	Uganda	✓	✓	✓	H	L
Huduma	Kenya				L	L
Daraja Maji Matone	Tanzania	✓			L	L
FixMyStreet	Georgia		✓		L	L
Check My School	Philippines	✓	✓		L	L
Barrios Digital	Bolivia				L	L
e-Chautari	Nepal				L	L
I Paid a Bribe	India		✓		M	L
Mejora Tu Escuela	Mexico				L	L
Karnataka BVS	India				L	L
Sauti Za Wananchi	Tanzania		✓		L	L

Source: WDR 2016 team, based on Peixoto and Fox 2015, for the WDR 2016.

Note: Examples are arranged by degree of government response. CSO = civil society organization. L = low; M = medium; H = high.

three were successful (table O.2). Of eight cases that did not involve a partnership, most failed. This suggests that, although collaboration with government is not a sufficient condition for success, it may well be a necessary one. Another ingredient for success is effective offline mobilization, particularly because citizen uptake of the digital channels was low in most of the cases. For example, Maji Matone, which facilitates SMS-based feedback about rural water supply problems in Tanzania, received only 53 SMS messages during its first six months of operation, far less than the initial target of 3,000, and was then abandoned.

Political participation and engagement of the poor has remained rare, while in many countries the internet has disproportionately benefited political elites and increased the governments' capacity to influence social and political discourse. Digital technologies have sometimes increased voting overall, but this has not necessarily resulted in more informed or more representative voting. In the Brazilian state of Rio Grande do Sul, online voting increased voter turnout by 8 percentage points, but online voters were disproportionately wealthier and more educated (figure O.19). Even in developed countries, engaging citizens continues to be a challenge. Only a small, unrepresentative subset of the population participates, and it is often difficult to sustain citizen engagement. There is no agreement among social scientists on whether the internet disproportionately empowers citizens or political elites, whether it increases polarization, or whether it deepens or weakens social capital, in some cases even facilitating organized violence.

The use of technology in governments tends to be successful when it addresses fairly straightforward information and monitoring problems. For more demanding challenges, such as better management of providers or giving citizens greater voice, technology helps only when governments are already responsive. The internet will thus often reinforce rather than replace existing accountability relationships between

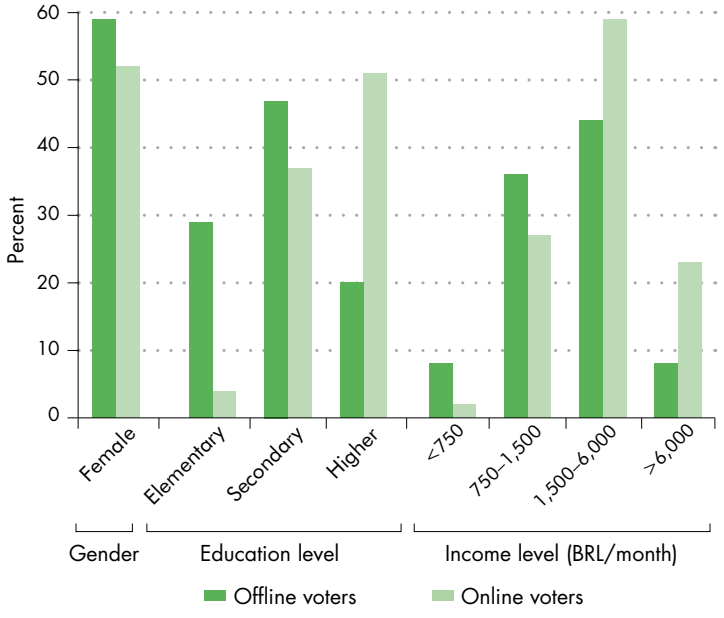
governments and citizens, including giving governments more capacity for surveillance and control (box O.6). Closing the gap between changing technology and unchanging institutions will require initiatives that strengthen the transparency and accountability of governments.

Making the internet universal, affordable, open, and safe

First-generation ICT policies involving market competition, private participation, and light-touch regulation have led to near-universal access and affordability of mobile telephony, but have so far been less successful in spreading internet services. Much of the explanation lies in continued policy failures such as regulatory capture, troubled privatizations, inefficient spectrum management, excessive taxation of the sector, and monopoly control of international gateways. At the same time the absence of global consensus in dealing with the next-generation issues—such as privacy, cybersecurity, censorship, and internet governance—is resulting in more circumspect and diverse approaches to regulating the internet (box O.7 and figure O.20).

Figure O.19 Internet voting can increase voter participation but can be biased toward more privileged groups

Profile of online and offline voters in a participatory budgeting vote in Rio Grande do Sul, Brazil, 2011–12



Source: WDR team, based on Spada and others 2015. Data at http://bit.do/WDR2016-FigO_19.

Note: BRL = Brazilian *real*.

Supply-side policies: Availability, accessibility, and affordability

A useful framework for analyzing supply-side ICT policies is to consider the value chain that stretches from the point where the internet enters a country (the first mile), passes through that country (the middle mile) to reach the end user (the last mile), and certain hidden elements in between (the invisible mile).

- The first mile can be improved by liberalizing the market for satellite dishes and eliminating monopoly status over the international gateway and cable landing stations.
- Strengthening the middle mile involves liberalizing the market for building and operating backbone networks, encouraging open access to the incumbent's network, requiring all major infrastructure programs (such as roads, railways, pipelines, and energy distribution) to include provision for an optical fiber link, setting up internet exchange points, and creating local caches for frequently used content.
- Government policies can encourage the provision of last mile connectivity by permitting competing facilities, especially for intermodal competition (between cable, wireless, and digital subscriber line), and mandating the incumbent to make local access lines available to competitors at wholesale prices (local loop unbundling).
- The most critical portion of the invisible mile involves spectrum management, which requires increasing the amount of spectrum available, ensuring competitive access, encouraging sharing of essential facilities, such as radio masts, and liberalizing the market for spectrum resale.

In addition to pure ICT policies, almost everything that the private sector, citizens, or governments do on the internet requires some essential building blocks (box O.8).

Demand-side policies: Open and safe internet use

The challenges facing internet stakeholders today are as much about how networks are used (demand) as how they are built (supply). Global interconnectedness introduces new vulnerabilities in areas where coordination mechanisms are weak, still evolving, or based on nongovernment models. Threats to cybersecurity, and censorship are undermining confidence and trust in the internet and increasing costs to businesses and governments, resulting in economic losses

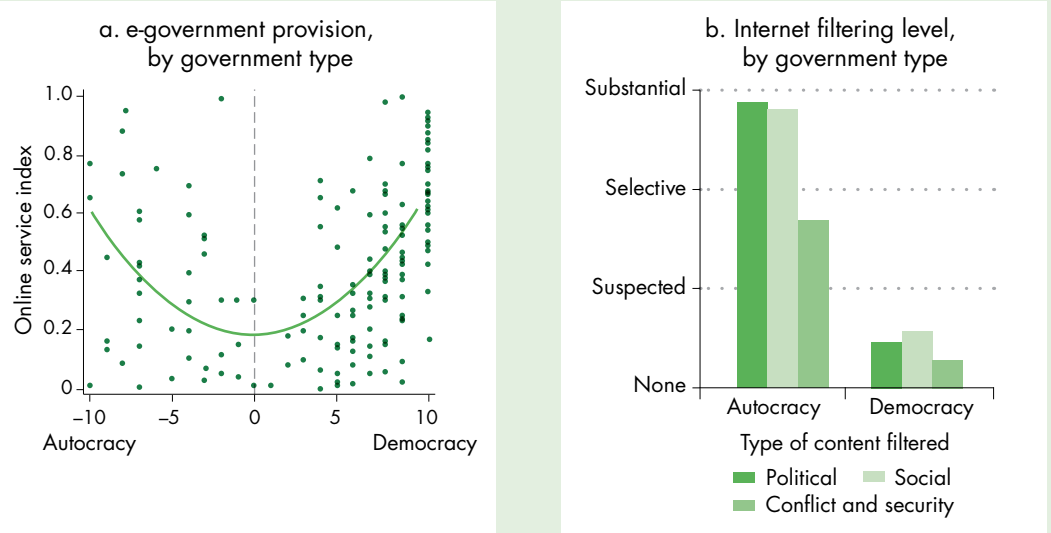
Box O.6 Nailing Jell-O to the wall—restrictions on the flow of information

Governments also interfere directly with digital networks to control access to information. An early internet pioneer, John Gilmore, claimed, "the Net interprets censorship as damage and routes around it."[a] And Bill Clinton in 2000 said, "trying to control the internet is like trying to nail Jell-O to a wall."[b] Yet private software vendors and state institutions have figured out ways to censor access to internet content, whether by shutting down the entire national web domain, as the Arab Republic of Egypt did in 2011 for five days; by preventing access to specific domestic or foreign websites; or by targeting individuals' blog posts or other social media postings. Google received 6,951 requests from governments in 2013 to remove content from search results, with the largest numbers from Turkey, the United States, and Brazil. Other countries, including China and the Islamic Republic of Iran, block Google and some other internet sites completely, although such restrictions may change in the future.

Governments of all types restrict access to content such as child pornography, hate speech, insults, or criticisms of authority figures, challenges to cultural or religious morals, or reporting of uprisings or accidents. When accountable governments determine what should be censored, the result reflects broad societal preferences. In autocratic countries, where use of the internet in government is often as high as in democratic countries (figure BO.6.1), leaders face a dilemma. If they permit open discourse on the internet, they risk challenges to their authority. If they do not, they risk isolating themselves from the global information economy. This is a balancing act, and countries are becoming more sophisticated in calibrating their control—for example, censoring content that might encourage collective action, but not individual criticism.

Internet filtering and censorship impose welfare and economic costs. First, the cost of censoring or filtering internet content diverts public funds from other uses. Monitoring domestic internet traffic and selectively blocking foreign websites requires large financial resources, technical know-how, and dedicated staff—all of which could be deployed for more productive tasks. Second, filtering and methods to circumvent it can slow the speed of internet access, which hurts business users. Third, filtering can restrict access to economically or scientifically useful information, such as the Google Scholar search engine for academic papers—indispensable in universities and labs. Fourth, in the view of the European Union, for instance, blocking foreign

Figure BO.6.1 Autocratic governments have promoted e-government while censoring the internet



Sources: WDR team, based on Polity IV 2015; UN 2014; Open Net Initiative 2013. Data at http://bit.do/WDR2016-FigBO_6_1.

Note: The Polity IV project defines government types based on characteristics such as competitiveness and openness of executive recruitment, constraints on the chief executive, and regulation and competitiveness of participation in the political process. The combined score varies from –10 for a pure autocracy to +10 for a pure democracy. See the Polity IV user's manual for details.

(Box continues next page)

Box O.6 Nailing Jell-O to the wall—restrictions on the flow of information *(continued)*

websites may be considered a nontariff trade barrier. Local companies will fill the gap. This could be considered an economic benefit or transfer rather than a cost. But it prevents domestic users' access to possibly better products, and domestic champions will not face as much innovation-inducing competition. Fifth, widespread censorship means that people avoid discussing and exchanging ideas openly, a prerequisite for an innovative and productive society.

Sources: WDR 2016 team, based on Saleh 2012; King, Pan, and Roberts 2013; Bao 2013; HRW 2015.

a. Elmer-Dewitt 1993.
b. Clinton 2000.

Box O.7 Is the internet a public good?

The internet does not have all of the characteristics of a pure public good. Access to the internet often requires a fee, so individuals can be effectively excluded from its use. But once on the internet, the consumption of information by one user does not reduce its availability to others, so in that sense it is nonrivalrous (although capacity constraints can slow down access). One way to describe the internet is as a club good that is excludable but nonrivalrous, similar to cable television; or if bandwidth is scarce, as a private good with strong positive externalities—everyone benefits as more people come online. As more essential services and information migrate to the web, anyone without access almost becomes a second-class citizen. And all citizens benefit when everyone else is better informed and when public services are provided electronically at lower cost.

The private sector should take the lead in providing internet infrastructure and services because the business case is usually compelling. But public investment or intervention is sometimes justified where the private sector is unable to provide affordable access. Historical precedents include the United States Communications Act of 1934, which called for universal "wire and radio communication service," even in remote rural areas. Some countries have gone further. Finland, for example, has defined access to the internet at broadband speeds as a legal right and pursues a universal access policy.

Source: WDR 2016 team.

Box O.8 The four digital enablers

The WDR 2016 looks at how the internet increases productivity of businesses, opportunities for people, and the effectiveness of governments. Across these domains, four major *enablers of digital development* are critical. Four spotlights in the Report discuss their benefits and potential risks.

Digital finance. Banks have been early and eager adopters of digital technologies, but many of the major innovations, such as online payments, mobile money, and digital currencies, have come from nonbank institutions, including telecom and internet companies. Some of these innovations took root first in developing countries, where they overcame shortcomings in traditional financial systems. Their benefits are distributed widely. Secure online payments fuel e-commerce. Electronic transfers reduce the cost of sending remittances. Peer-to-peer lending can vastly improve the financial access of startups. Governments can make payments and social transfers at lower cost and with less fraud and leakage. However, if financial regulations don't keep pace with the rapid technological progress, these innovations could risk affecting the stability of the overall system.

Social media. Social networks are fundamental to human society, and digital technologies have accelerated their formation. More than one-fifth of the world's population is now believed to be a member of one or more social media platforms. These platforms have been credited with facilitating economically beneficial interactions, channeling users'

(Box continues next page)

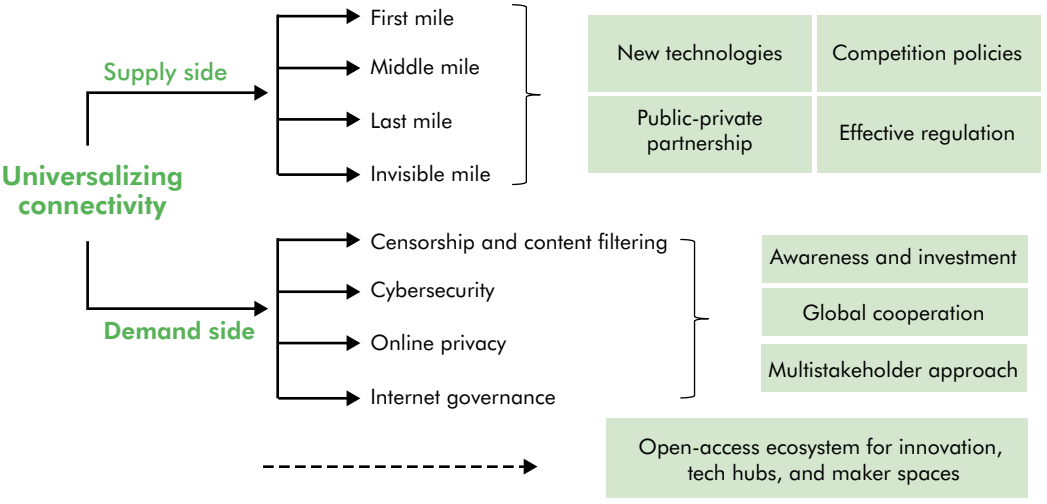
Box O.8 The four digital enablers *(continued)*

behavior in ways that are consistent with development, providing a platform for information and dissemination during natural disasters and emergencies, and encouraging political mobilization and social change. Some analysts think that social media played a critical role in recent events such as the Arab Spring and Occupy Wall Street, and thereby were instrumental in spreading democratic ideas, although many remain skeptical of their actual impact. There is still much to learn about the role social media can play in development. While a source for innovative ideas, social media also remain conduits for gossip, slander, misinformation, harassment, bullying, and crime. One important lesson is that the impact of social media on development seems to be highly specific to context. Variation in access to technology, education, and broader sociopolitical context matters. For instance, there is evidence that people in more autocratic countries are less likely to forward information (for example, by re-tweeting it).

Digital identity. Being able to prove who you are may seem trivial, but it can be transformational for those excluded from jobs and services. Simple electronic identification systems, often using biometric characteristics, have become an effective platform for secure bank transactions, voting, accessing social services, paying utility bills, and much more. Many countries, from Moldova to Nigeria and Oman, have introduced digital IDs. India is on track to register its entire population using its Aadhaar digital ID. In Estonia and other countries, thousands of different types of public and private transactions are verified with a unique electronic ID system, including legally binding contracts and voting in national elections.

Data revolution. In harnessing data for development, attention focuses on two overlapping innovations: "big data" and open data. Big data are voluminous or fast, and they come from myriad sources—from satellites to sensors and from clouds to crowds. Big data analytics is being deployed to improve traffic planning, estimate macro aggregates (also referred to as "nowcasting"), track the spread of epidemics, and improve credit scoring and job matching. Open data are those that are freely and easily accessible, machine-readable, and explicitly unrestricted in use. Governments are, or could be, the most important source of open data. Exuberant estimates of the current and potential economic value of big data and open data range from hundreds of billions to trillions of dollars per year. Yet sustained, impactful, scaled-up examples of big data and open data in developing countries are still relatively rare. Most big data are in private hands—large telecom and internet companies—which are reluctant to share it for fear of jeopardizing customer privacy or corporate competitiveness. Public agencies, too, are reluctant to share data, even when they have large public benefits. For example, of countries surveyed by the Open Data Barometer, one-third of the high-income countries and 85 percent of developing countries had made little or no progress in opening map data. Reasons include lack of technical skills, inadequate resources, and unwillingness to expose data to scrutiny.

Figure O.20 A policy framework for improving connectivity



Source: WDR 2016 team.

as well as higher security spending. For privacy and data protection, different countries are taking quite different approaches. That makes it harder to develop global services. Ensuring safe and secure access will require enhanced international collaboration, based on a multistakeholder model.

Analog complements for a digital economy

The internet has great potential to promote economic development, but only some of that potential has so far been realized. It disrupts established markets for products, services, and labor, and it disrupts the public sector—major reasons for the frequent reluctance to adopt and deploy the internet more broadly. But the benefits will come to those who embrace the changes the internet brings, not to those who resist them. And the way to get internet-enabled inclusive growth without long-term disruption is to strengthen the analog complements of digital investments (box O.9). Three policy objectives emerge from the analysis in the Report:

- A business environment where firms can leverage the internet to compete and innovate for the benefit of consumers
- Workers, entrepreneurs, and public servants who have the right skills to take advantage of opportunities in the digital world
- An accountable government that effectively uses the internet to empower its citizens and deliver services.

What these priorities highlight is that core elements of the development agenda—business regulations that ease market entry, education and training systems that deliver the skills that firms seek, and capable and accountable institutions—are becoming more important with the spread of the internet. Not making the necessary reforms means falling farther behind those who do, while investing in both technology and its complements is the key to the digital transformation.

Internet use still varies greatly between countries, as does the quality of complements, and both tend to move up with income (figure O.21). Policy priorities change as countries move along the digital transformation (figure O.22). Countries where internet use is still low should lay the foundation—such as removing barriers to internet access and adoption, promoting basic and digital literacy, and using the internet for elementary government functions like provision of information. As countries transition to higher levels

Box O.9 Technology and complements: Lessons from academic research

Recent research on growth, labor markets, and governance has taken a fresh look at the interplay between technology and other factors. These insights inform the discussion of policy priorities in this Report.

Rules. Technology interacts with rules (such as regulations and standards) to create new ideas, such as new ways of producing goods and services. Technology is traded across markets and borders, while most rules are established locally. When it encounters rules that do not match, technology fails to deliver the expected benefits. New businesses can acquire internet technology to reduce prices and increase convenience for consumers, but they will not be able to enter the market and compete if local regulations protect incumbents.

Skills. Technology interacts with workers' skills. It allows routine tasks to be automated. Workers with the right abilities will leverage technology to become more productive. Consider a modern office assistant who uses digital technologies to perform routine tasks quickly, and now spends far more time on personal interaction, complex scheduling, and other tasks that computers cannot easily perform.

Institutions. Technology interacts with discretion. Many tasks in government can also be automated, but others involve a high degree of judgment. That means that even as the internet can make many public service functions more efficient, the benefits will be limited when government officials and workers do not have the incentives to use the technology for the public good. Teacher attendance can be fairly easily monitored using digital technologies, but the quality of teaching depends on the teacher's training, resources, ability, and motivation.

Sources: Romer 2010; Autor 2014; Pritchett, Woolcock, and Samji, forthcoming.

Figure O.21 The quality of complements and technology rises with incomes

Source: WDR 2016 team. For more details see figure 5.3 in the full Report. Data at http://bit.do/WDR2016-FigO_21.

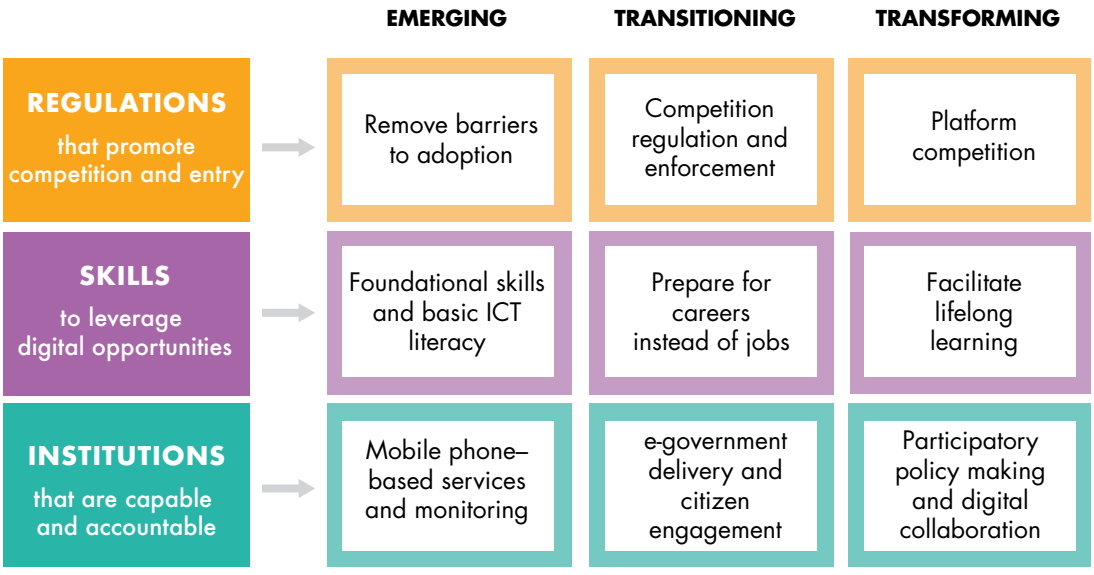
Note: Technology is measured by the Digital Adoption Index (DAI). DAI is based on three sectoral subindexes covering businesses, people, and governments, with each subindex assigned an equal weight: DAI (Economy) = DAI (Businesses) + DAI (People) + DAI (Governments). Each subindex is the simple average of several normalized indicators measuring the adoption rate for the relevant groups. Similarly, *complements* is the average of three subindicators: starting a business; years of education adjusted for skills; and quality of institutions.

of internet use, they require effective competition regulation and enforcement—including easy firm entry and exit; a greater focus on advanced cognitive and socioemotional skills that are augmented by technology; and effective e-government delivery systems for provider management and citizen engagement. Countries in advanced stages of the digital transformation need to tackle some of the most challenging tasks. They need to find ways to facilitate "new economy" competition, to ensure lifelong learning and respond to the changing nature of work, and to use the internet for most functions of government and for more participatory policy making.

Regulations that promote competition and entry

Digital adoption by firms varies among countries, and there are reasons for it to be slow. Most fundamentally, adoption requires knowledge about the technology, access to it, and knowledge of how to best apply it. But the most important driver is competitive pressure, as firms adopting new technology

Figure O.22 Policy priorities for countries that are emerging, transitioning, or transforming



Note: ICT = information and communication technology.

raise productivity and those who don't fall behind. This highlights the critical role of a country's business climate. It includes laws and regulations that ensure easy entry and exit of firms, and an open trade regime that exposes companies to foreign competition and investment. There is a political economy dimension to this as well—special interests influence regulators to keep markets closed to competition. This lessens the need for firms to reach for the technological frontier. Where banks are heavily regulated and protected from new market entrants, they have less incentive to invest in efficiency-boosting technology that might also help them serve customers better or reach new ones. But competition policy and enforcement are complex, and many low-income countries lack capacity to design and implement them effectively.

Lower the barriers to digital adoption

In countries where the digital economy is still emerging, the priority is to facilitate connectivity and develop the foundation for effective competition regulation. Although 74 mostly middle- and high-income countries have unilaterally removed tariffs on ICT capital goods, computers and smartphones are still treated as luxury goods in some countries, including Turkey, where taxation adds almost half to the price of mobile handsets.[33] Djibouti's tariff on computers is 26 percent. Many countries treat their telecom firms as cash cows. Where firms may have limited knowledge about how the internet can improve their business, benchmarking exercises and information programs can be effective. And to allow more innovative companies to enter markets easily, countries need to improve firm registration and create greater market transparency to reduce price collusion, market sharing, and rigged public procurement. E-government systems such as online business registration and e-procurement systems can simplify these processes and produce more openness.

Increase competition through effective regulation and enforcement

State control in economic sectors, barriers to entrepreneurship, and restrictions on trade and investment reduce the incentives for firms in protected sectors to use digital technologies. Most countries have a competition authority, although many were set up fairly recently and enforcement varies, especially when the state or politically connected firms benefit from market restrictions. Moreover, the internet makes it easy to deliver services online from anywhere in the world, so how trade in services is regulated becomes increasingly important. Ethiopia, India, and Zimbabwe have the greatest restrictions on service trade, but many other countries restrict specific services such as legal or accounting tasks. Countries can increase the competitiveness of their economies and encourage greater use of digital technologies by gradually reducing market distortions while building up effective competition enforcement. This applies as

Box O.10 Opening the M-Pesa mobile money platform to competition

Safaricom's mobile money system is a well-known success story. It was able to grow quickly because Kenya's banking regulators initially decided to take a hands-off approach. For seven years, Safaricom maintained a dominant position through exclusivity agreements locking agents into the system. Initially such arrangements were perhaps justified because Safaricom incurred high costs developing the system. But in 2014, Kenya's Competition Authority changed the rules and opened the system to alternative mobile operators. The transaction cost of transfers of up to K Sh 500 (US$4.91) fell from K Sh 66 to K Sh 44 (US$ 0.43).

Source: Plaza, Yousefi, and Ratha 2015, for the WDR 2016.

much to traditional businesses that use the internet as to internet platforms (box O.10).

Tailor "new economy" regulations to ensure competition

Internet firms create new business models and change market structure, posing new challenges for regulatory authorities. On-demand economy firms like Uber and Airbnb scaled up traditional ride sharing and subletting to a global scale. But regulators struggle to determine whether these companies are taxi or hotel companies or simply software providers. Offline competitors complain that they do not follow the same regulations. Where these industries tend to be overregulated and their markets distorted, as is often the case in the taxi business, this new competition can encourage a general overhaul of the industry. In the United States, cities like New York and states like Massachusetts have begun to develop appropriate regulations for these platforms, imposing safety and tax obligations but also reducing their competitors' regulatory burdens.

Similar regulatory puzzles are posed by firms such as Amazon, Facebook, and Google. For example, Google is known as a search engine company but is better described as an advertising firm. These firms confound conventional competition law because they do not act as traditional monopolies. Their services are often free to consumers. But given their dominance in the markets for online ads and books, they have considerable leverage over marketers and booksellers. This is similar to credit card companies' position with respect to retailers. Research by economists such as Jean Tirole has shown that regulations in such industries must be carefully tailored to guarantee competition and avoid harm to consumers. These are very challenging problems, and most pressing in the transforming countries. Developing countries have the benefit of being able to learn from the experience in the transforming countries before devising their own solutions.

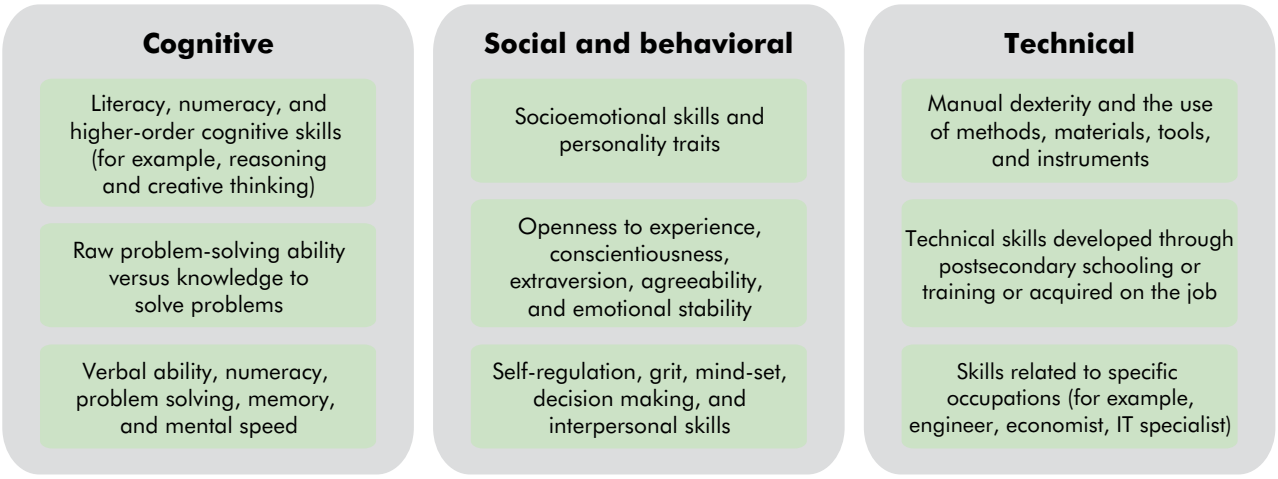
Skills for the digital economy

Technological change means that many routine tasks will soon be done by machines. In contrast to previous episodes, the internet will also make many tasks carried out in white-collar jobs redundant. This puts a premium on different types of skills that automation complements rather than replaces (figure O.23). Education systems have been slow to respond to this challenge. Furthermore, the pace of change is fast, and the types of skills in demand change quickly. So workers will have to upgrade their skills frequently throughout their careers. These dynamics already play out in many transforming and some transitioning countries, but even for emerging countries it is not too early to prepare.

Start early with foundational skills

Skills development starts at birth and lasts a lifetime. Good parenting and early stimulation prepare children for school, where cognitive and socioemotional foundations are laid. Technology can play a role. Even though the record on simply providing laptops or tablets to students is mixed, videoconferencing with English speakers from the Philippines has improved learning among first graders in Uruguay. Khan Academy provides resources for independent learning, and using a gaming approach to math teaching benefited grade four children in Mumbai. But in these and many other cases, one factor was more important: the quality of teaching. It is no coincidence that Finland, one of the most connected and best-performing countries in educational testing, uses very little technology in the classroom. It takes time to improve the quality of teachers,

Figure O.23 The types of skills needed in a modern economy



Source: WDR 2016 team, adapted from Pierre, Sanchez Puerta, and Valerio 2014.

Note: IT = information technology.

however. But technology can help here as well, as Rio de Janeiro's Educopedia platform shows (box O.11). Using technology to closely guide teaching is a second-best option that can improve learning outcomes at modest cost where teacher training is unlikely to improve quickly. This is the model used by the for-profit Bridge Academy in Kenya and elsewhere, where scripted instruction and automated administrative tasks help provide education at low cost. Although yet to be evaluated rigorously, such approaches hold promise to improve education.

Rethink curricula and teaching methods

Today's education systems need to prepare students for a career and not only a job. Modern labor markets require creativity, teamwork, problem solving, and critical thinking in ever-changing environments—skills that traditional education systems do not teach and that are hardest to measure. Many countries are rethinking their approach. Singapore is moving from a fairly rigid "efficiency driven" model that tried to get the best results from inputs (teachers and finance) to an "ability driven" model that emphasizes project work and fewer assessments in place of frequent testing. Colombia's Escuela Nueva model, now serving 5 million students in 16 countries, also focuses on group learning and problem solving. These approaches change the relationship between teacher and student. No longer simply sources of information, teachers now must instruct students in how to find information and apply it in a new and unexpected context. This requires changes in teacher training. There are many examples of how digital technologies can assist teachers and students—by allowing group

Box O.11 Mobilizing technology in teaching in Rio's Educopedia

Rio de Janeiro's education department developed the Educopedia online platform of lessons and other resources in 2010 to improve public school teaching. The system focuses as much on providing materials for the teacher to improve lessons as on giving students access to learning resources. The system uses multimedia resources including videos, interactive quizzes, and digital libraries. It now serves almost 700,000 students. It has yet to be formally evaluated, but together with other reforms it likely contributed to a more than 20-percent increase in the Basic Education Development Index in middle schools between 2009 and 2012. And 80 percent of Rio's students agreed that Educopedia helps their learning efforts.

Source: Bruns and Luque 2014.

work among classrooms connected online, apps that stimulate creativity and problem solving, and games designed for education ("gamification").

Develop advanced technological skills and encourage lifelong learning

As more and more parts of the economy rely heavily on the internet, demand for advanced ICT skills will also grow. Only a small share of the workforce will be involved in developing software or systems design, but exposing children to coding and basic ICT concepts can influence career choices for some and impart a basic understanding to many. NairoBits, a youth organization in Kenya, exposes underprivileged young people from informal settlements to web design and other ICT skills, while AkiraChix reaches out to "geek girls." Women tend to be underrepresented in ICT fields, and encouraging girls to enter such professions and ICT companies to create welcoming environments for women will increase the available workforce in fields with rising demand for labor. With technology likely continuing to get more advanced and affecting ever more occupations, workers need to continuously reevaluate and upgrade their skills. Much of that will happen outside the formal education system, but governments can provide the incentives for firms and workers to create the mechanisms for lifelong learning.

Institutions that are accountable to citizens

Although the internet has enabled many governments to provide some basic services more efficiently, technology so far has not strengthened accountability. For policies, this implies a dual strategy: tailoring the application of digital technologies to environments with limited accountability in the short term, and strengthening institutions in the longer term (table O.3).

Improve informational services and monitoring

Although internet access is still low in many emerging economies, mobile phones are widespread and have great potential for improving services. In the health sector, simple mobile phone–based reminders for taking medications have been effective for HIV patients in Malawi and for providing maternal health information in the Democratic Republic of Congo. Phones can support the monitoring of teachers or other government workers where absenteeism is a problem, even if monitoring alone is insufficient to improve service quality or outcomes (box O.12). Monitoring also becomes important in provision by nonstate entities in weak institutional contexts, where for-profit or non-profit organizations deliver services often funded by the government. And digital technologies can improve electoral accountability. In Afghanistan, Kenya, and Mozambique, election monitoring using cellphones helped uncover fraud and reduced election violence. This can complement—or, even in low-capacity settings, replace—more demanding approaches such as biometric identification (see spotlight 4 in the full Report).

Strengthen e-government delivery and citizen engagement

Where investments to automate government service delivery have advanced, complementary improvements in regulations, interdepartmental cooperation, and streamlining become more important. Rather than just replicating cumbersome processes such as business regulations online, automation provides an opportunity for simplifying steps, increasing the impact as well as the transparency. E-procurement systems reduce the risk of corruption, but countries have invested less in them than in more complex budget or treasury systems. With greater internet use in a country, the scope for

Table O.3 Priority policies for better service delivery

Emerging countries: Laying the foundation for more effective institutions	Transitioning countries: Building capable and accountable institutions	Transforming countries: Deepening collaborative institutions
• Improve information services to citizens • Strengthen monitoring of and payment to providers • Establish population registers • Scale up nonstate provision of services • Increase electoral accountability	• Strengthen government delivery systems • Strengthen provider management • Get regular user feedback on service quality • Increase transparency in priority areas	• Improve collaboration across and beyond government • Enhance participatory policy making

Box O.12 Can continuous monitoring and small sanctions improve provider performance?

Traditional monitoring systems are expensive and complex. New technologies lower these costs, allowing rewards or punishment to be more immediate and frequent. The idea comes from criminal justice innovations. Usually lawbreakers face a low probability of being caught, but a large punishment. When people face a high probability, but fines are lower, violations become rarer. The idea could be extended to public service monitoring. In Niger, a well-designed monitoring system enabled by mobile phones motivated teachers because they felt their far-away superiors cared about their work and looked out for them.

Sources: Romer 2013; Aker and Ksoll 2015.

digital engagement with citizens also increases. As long as access is not universal, there is a risk of leaving those unconnected behind. But citizen feedback systems have reduced problems such as petty corruption or poor services in the Dominican Republic, Nigeria, and Pakistan. As one Kenyan water utility manager said, "By introducing an automated complaint management system we took a noose and put it around our own necks. We are now accountable!"

Deepen collaboration and participatory policy making

Even in countries with advanced e-government systems, their use remains surprisingly low. Many citizens prefer traditional ways of interacting with the government such as phones or mail, so parallel systems remain in place and savings go unrealized. Providing incentives such as faster tax refunds for e-filing or greater convenience through simplified and closely integrated services across agencies increases their use. Estonia's X-Road framework integrates services from all parts of government as well as private or civil society groups according to protocols that govern data exchange and security standards.[34] Practically any transaction—from paying the parking meter to voting in national elections—can be done from a smartphone. Tangible benefits for citizens will lead to universal use of e-government services, making such platforms also suitable for broad-based participatory policy making.

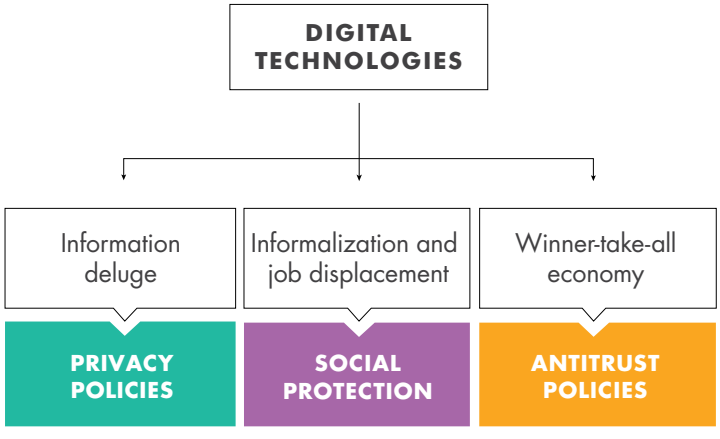
Digital safeguards

Strengthening analog complements will ensure a high social and economic return from digital investments. But a downside risk remains. Returning to the Report's framework (figure O.24), large-scale collection of identifiable information creates privacy and security concerns. Automation changes work in ways that challenge existing social protections and reveal the inadequacy of existing labor laws. And scale economies create antitrust concerns. Digital safeguards that mitigate these risks become increasingly important as the digital transformation proceeds.

Developing privacy policies

The flood of data collected on the internet brings many benefits to consumers and citizens but also raises the risk of abuse through cybercrime, discrimination, or manipulation. As of 2014, some 107 countries had privacy laws, but only 51 of them were developing countries. The basic principles of privacy law are well established. They should give users more control (and perhaps co-ownership) over their data and make

Figure O.24 Digital safeguards in the WDR's framework



Source: WDR 2016 team.

opting out at the point of collection easier. Even when such laws exist, preventing abuse is difficult, especially where legal and enforcement capacity is weak.

Adapting social protection systems to changing labor markets

Better skills will help many workers cope with the effects of internet-enabled automation. But changes in the labor market also require rethinking social protection and tax systems. The on-demand economy leads to more informal employment, transferring insurance and occupational obligations to freelance workers. Strict labor regulations, common in developing countries, and overreliance on labor taxation encourage faster automation by making hiring more expensive. It would be better to strengthen workers' protection independently from work contracts by delinking social insurance from employment, offering independent social assistance, and helping workers retrain and find new employment quickly. In many countries this requires major reforms. And countries just starting to develop social protection systems and deepening labor laws should design them for the 21st-century workplace, rather than copy what industrialized countries created for a very different world of work.

Building antitrust enforcement capacity

Regulatory reform that improves the business environment is the first priority. But even in countries with comprehensive competition policies, including easy market entry and exit, there will be cases in which mergers, collusion, or discriminatory pricing harm consumers by creating overly dominant enterprises or by keeping innovative competitors out. Because the internet is still quite new and its impact on markets constantly evolving, developing the capacity to investigate and prosecute complex violations to competition law will take time. Cases pursued in high-income countries can provide guidance.

Global cooperation to solve global problems

The internet is truly an international network. It can be better managed with coordination across nations and serve as a powerful platform to facilitate global cooperation. Three priority areas are governing the internet, creating a global digital market, and providing global public goods—including those that promote poverty reduction and environmental sustainability.

Governing the internet

The internet emerged from U.S. government research in the 1970s, but as it grew into a global network of networks, its governance structure has evolved. Today, the internet is managed by an international coalition of governments, industry, technical experts, and civil society—in what is referred to as the multistakeholder model. U.S. users are now a small minority of total internet users, given the dramatic growth in the number of users in developing countries, especially in Asia. Many countries are demanding more meaningful representation in the discussions of how the internet should be governed. In addition, the lack of trust among nations following the Edward Snowden episode, the surveillance by state agencies, and the increasing conflicts between national policy and regulations and global norms have raised questions about internet governance.

Several countries have advocated for a multilateral model of governance, which would give national governments greater power in overseeing the internet, much the same way the United Nations, the International Telecommunication Union, or the World Bank are currently governed. The promoters of "multistakeholderism" argue that state control of the internet would not leave space for the range of players currently involved in internet governance and could pave the path for greater suppression of privacy and restrictions on access to information and on rights of free expression. The inability of the stakeholders of the internet to reach a consensus on future governance mechanisms can be costly; some have even suggested that the internet is at risk of splitting up into several local or regional internets. The broad-based, participatory approach involving all stakeholders is seen by many to be best suited to ensure an efficient and unrestricted global flow of information essential for economic development.

Creating a global digital market

The internet is encouraging more cross-border exchanges of goods and services, allowing consumers and firms to bypass national borders. But cross-border issues—such as barriers to data flows and uncoordinated intellectual property rights regimes—are impairing the growth of internet firms and robbing consumers of gains from increased digital trade. This has also meant that many startups from smaller countries with relatively modest domestic markets, particularly in Europe (box O.13), are moving their business to the United States as soon as they achieve a certain scale. The small scale imposed by cross-border barriers may also partly explain why e-commerce firms are

Box O.13 European Union: A fragmented market for digital trade

Despite being a single market with free flows of goods, services, and people for many decades, the European Union (EU) still functions like a fragmented market for digital trade. Consumers in the EU prefer to shop from online stores within their national borders. While 44 percent of consumers made an online purchase from a domestic business in 2014, only 15 percent did so from a business in another EU country. Firms also face many difficulties selling their goods and services online into other EU markets. For example, Copenhagen, Denmark, and Malmo, Sweden, are separated only by an 8-kilometer bridge, but a package sent from Copenhagen to Malmo costs €27, whereas the same package sent from Malmo to Copenhagen costs €42. Firms facing large costs to adapt to various national laws believe that the costs outweigh the benefits of selling online.

In May 2015, the European Commission (EC) announced plans to create a Digital Single Market, in three main policy areas. First, the EC wants to increase the access for consumers and firms to these digital goods and services by facilitating e-commerce, improving parcel delivery, and dealing with geoblocking, where access to online services or content is restricted to specific countries. Second, it will examine the regulatory environment for telecoms, media, online platforms, and data protection. Third, it will encourage more ICT investment and innovation through better standards and interoperability, and more use of "big data" and cloud computing. If EU reforms to create a common digital market are successful, they could become a model for other world regions.

Source: European Commission (EC 2015).

often losing money in Africa while being profitable in China and India.

Some countries are considering regulations that make it legally binding for data of or about their citizens to reside within their national borders, also referred to as data localization or data nationalism. While such barriers may stem from legitimate concerns about privacy and security for their citizens' information, they can be costly. A study of six developing countries and the EU-28 found that such regulations can reduce GDP by up to 1.7 percent, investments up to 4.2 percent, and exports by 1.7 percent.[35] Restrictions on data flows face the risk of becoming a new tool for protectionism—disguised to impede trade and economic activity or to encourage domestic data-driven sectors. At the same time, countries should make it easier for firms to protect their intellectual property (IP) rights—but within limits that do not give excessive protections to large, well-connected firms at the cost of stifling innovation and creativity. The process to apply for IP licenses should be harmonized, streamlined, and globalized—so firms need only to register their patent or trademark in any signatory country to protect it across member countries.

Providing global public goods

Sustainable development and poverty reduction are a focus of global partnerships. Many environmental problems—climate change, ozone depletion, air pollution, epidemics—are features of globally interconnected environmental, economic, and social systems and require global cooperation. What's the role of development agencies, nongovernmental organizations (NGOs), and international organizations in a world where their financial heft is small? The data and technology revolutions arrive in time to bridge the gap between their resources and ambition by amplifying the impacts of action and including more people in the formulation and execution of plans. But for this to work, development actors must tackle policy constraints, internal and external.

Start with the *how* of development operations. With new technologies, development agencies can be more inclusive by tapping on beneficiary wisdom in designing interventions. They can raise efficiency by using rapid feedback to refine and improve their actions through trial and error. But these approaches won't come easily in organizations that emphasize spending and outputs over results, have burdensome structures for accountability, and see any failures as damning rather than informative. If traditional agencies can't adapt, some of their business may be taken up by disruptive newcomers.

Next, the *what*. Development agencies can support information services that help individuals and systems managers make better decisions in ways that promote poverty reduction. These services have fixed

set-up costs in software and data assembly, but can have near zero costs for distributing information. So the private sector will tend either to shy away from providing these services, or will price them at a level that shuts out poor people who could benefit. One area where the need for international cooperation and support is particularly acute is the collection and distribution of data on weather, climate, and transboundary water flows, which are critically important to tackle climate change, improve natural resource management, and support agriculture.

External agents and international organizations can help with targeted funding—for instance, filling the gap in African weather stations. They can support the complementary investments for information platforms. And they can find ways to encourage public and private sectors, in both the developed and developing world, to open and share data for public goods.

Reaping digital dividends for everyone

Digital technologies are transforming the worlds of business, work, and service delivery. These advances are making the leading parts of the economy and society more productive—even as many still wait for the most basic benefits of the digital revolution. This Report argues that to ensure that everyone will reap the dividends of the internet, focusing on access to technology is essential but far from sufficient. Why? Because technology needs to be complemented by improvements in areas that determine whether firms, people, and governments can make effective use of new digital tools. The analog foundation cannot be strengthened overnight. It requires overcoming some of the most protracted development challenges: how to create an environment for firms to thrive, how to build effective education and training systems, and how to make service providers more responsive to citizens. The stakes are high, because the digital revolution leaves behind countries that do not make the necessary reforms. For those that do, technology investments will produce ample digital dividends, and these dividends will be widely shared among all stakeholders.

Notes

1. References to this and other data and citations in the overview may be found in the full Report.
2. The lag between technology creation, adoption, and learning to use it most effectively explains some of this. Difficulties in measuring technology's role are another partial explanation for the gap between individual cases of substantial benefits and modest macro effects. Technology impact is diffused throughout the economy, the world of work, and many aspects of personal life. And many benefits come in the form of higher quality or convenience—nonmonetary benefits not reflected in GDP numbers.
3. Even if rapid progress in artificial intelligence could solve some of these problems, it could take decades (see spotlight 6 in the full Report). In the meantime, it would be unwise for policy makers to simply wait and watch.
4. Acemoglu and Robinson 2014.
5. See Comin 2014.
6. See Graham and Foster 2014.
7. While the internet reduces the cost of information, it does not necessarily reduce the effort it takes humans to process that information. In fact, information overload, in combination with behavioral biases, can promote herd behavior, amplify facts, or even be abused for marketing or manipulation.
8. Overcoming information problems also improves market efficiency and could even lead to greater innovation. For expositional simplicity, the Report's framework is simplified and focuses on the most important development outcome associated with each mechanism that is enabled by the internet.
9. Moreover, cross-country regressions measuring the impact of digital technologies on growth could suffer from several other problems involving measurement issues, endogeneity of variables, and small sample size bias.
10. These results are based on Tan 2015; Osnago and Tan 2015.
11. eBay 2013.
12. Baldwin 2011.
13. Brynjolfsson and McAfee 2014.
14. Moretti and Thulin 2013.
15. Goyal 2010; Aker and Mbiti 2010.
16. See Handel 2015; Best and others 2010; Jagun, Heeks, and Whalley 2008; Aker 2011; Martin 2010.
17. Pineda, Aguero, and Espinoza 2011.
18. Asad 2014.
19. Aker and Mbiti 2010; Pineda, Aguero, and Espinoza 2011.
20. The survey was conducted by Research ICT for Africa.
21. Aker, Collier, and Vicente 2013.
22. See box 3.5 in chapter 3 of the full Report.
23. Duflo, Hanna, and Ryan 2012.
24. Acemoglu, Hasan, and Tahoun 2014.
25. Bennet, Breunig, and Givens 2008.
26. Hollenbach and Pierskalla 2014.
27. Goldin and Katz 2008.
28. Varian 2003.

29. Data for 2014 of net digital worldwide ad revenue shares from eMarketer, an online market research company.
30. Wood 2011.
31. Eden and Gaggl 2014.
32. WDR 2016 team estimates, based on household surveys. See chapter 2 in the full Report for details.
33. A landmark agreement that will further boost digital adoption around the world is the Information Technology Agreement, concluded by World Trade Organization (WTO) members on July 24, 2015. It will eliminate tariffs on more than 200 ICT products, valued at $1.3 trillion in global trade.
34. Vassil 2015.
35. Bauer and others 2014.

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DIGITAL DIVIDENDS

Digital technologies are spreading rapidly, but digital dividends—the broader benefits of faster growth, more jobs, and better services—are not. If more than 40 percent of adults in East Africa pay their utility bills using a mobile phone, why can't others around the world do the same? If 8 million entrepreneurs in China—one-third of them women—can use an e-commerce platform to export goods to 120 countries, why can't entrepreneurs elsewhere achieve the same global reach? And if India can provide unique digital identification to 1 billion people in five years, and thereby reduce corruption by billions of dollars, why can't other countries replicate its success? Indeed, what's holding back countries from realizing the profound and transformational effects that digital technologies are supposed to deliver?

Two main reasons. First, nearly 60 percent of the world's population are still offline and can't participate in the digital economy in any meaningful way. Second, and more important, the benefits of digital technologies can be offset by growing risks. Startups can disrupt incumbents, but not when vested interests and regulatory uncertainty obstruct competition and the entry of new firms. Employment opportunities may be greater, but not when the labor market is polarized. The internet can be a platform for universal empowerment, but not when it becomes a tool for state control and elite capture.

The *World Development Report 2016* shows that while the digital revolution has forged ahead, its "analog complements"—the regulations that promote entry and competition, the skills that enable workers to access and then leverage the new economy, and the institutions that are accountable to citizens—have not kept pace. And when these analog complements to digital investments are absent, the development impact can be disappointing.

What, then, should countries do? They should formulate digital development strategies that are much broader than current information and communication technology (ICT) strategies. They should create a policy and institutional environment for technology that fosters the greatest benefits. In short, they need to build a strong analog foundation to deliver digital dividends to everyone, everywhere.

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